

The Polyplacophora of the Red Sea

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ABSTRACT

This paper revises the Red Sea chiton fauna, of which 23 species are thus far recorded. One new species is described (*Leptochiton (Parachiton) hylkiae* n. sp.) and two species are new for the Red Sea (*Leptochiton nierstraszi* Leloup and *Leptochiton (Parachiton)* sp.). Of these 23 species, five [*Lepidozona luzonica* (Sowerby), *Callistochiton adenensis* (E.A. Smith), *Schizochiton jousseaumei* Dupuis, *Chiton peregrinus* Thiele and *Chiton (Rhyssoplax) heterodon* (Pilsbry)], probably only occur in the southernmost part of the Red Sea. Records of chitons from the central and southern Red Sea are very scarce and most of the data available are based on old literature records and museum specimens.

As far as chitons are concerned, the Red Sea does not constitute a separate zoogeographical entity, but is part of the tropical western Indian Ocean zoogeographical province. Only 2 species (*L. (P.) hylkiae* n. sp. *Lucilina perligera* Thiele) are endemic to the Red Sea.

Lessepsian migration (from Red Sea to Mediterranean) of chitons is known only for *Chiton (Tegulaplex) hululensis* (E.A. Smith), recorded from the Mediterranean coast of Israel. There are no reliable records of antilessepsian migration.

Lectotypes are designated for *Lepidopleurus concharum* De Rochebrune, *Chiton (Clathropleura) ruepelli* Thiele, *Chiton lyellii* Sowerby, *Chiton laqueatus* Sowerby and *Acanthochiton curvisetosus* Leloup.

INTRODUCTION

The Red Sea is a well defined area extending approximately 2200 km in length. In this study the limits of the Red Sea are set between Port Said in the North and Barim Island (Bab al Mandab Straits) in the South. The Suez Canal is included here as its molluscan fauna consists predominantly of Red Sea species.

Although the molluscan fauna of the Red Sea has been relatively well investigated, knowledge of the Polyplacophora remained rather poor and was scattered among many small publications. The present study aims to summarize and to verify as much as possible all available literature records of Red Sea Polyplacophora and to supplement these data by studying previously unrecorded material.

Although the Red Sea is well known for its exceptional high water temperature and salinity, it is not yet precisely known to what extent this may effect the constitution of the shallow water fauna. However these factors seem to have an impoverishing effect on the deep water fauna of the Red Sea, which greatest depth is 2800 m. Deep water dredging by the Austrian Pola expedition (1895/1898) and recent expeditions, of which the most important is the German Meteor expedition (1987), did not yield a single polyplacophoran specimen (Dr. R. Janssen in litt., 1989). Consequently all material reported in this paper was collected intertidally or in subtidal shallow water. A few specimens were dredged or

SCUBA-dived in depths up to 30 m, but the vast majority was collected between high water level and about 2-3 m depth.

Hopefully this revision will stimulate further research (as several questions remain unanswered), and facilitate identification of Red Sea Polyplacophora.

HISTORICAL REVIEW

The first to report the existence of chitons in the Red Sea was Spengler (1797: 76-78), who described *Chiton testudo* (= *Acanthopleura vaillantii* De Rochebrune?) from material collected by P. Forsskål during the Arabian Expedition (1761-1763). This was followed by Savigny (1817: pl. 3) who gave excellent illustrations of: *Acanthopleura vaillantii* (De Rochebrune, 1882), *Acanthochitona penicillata* (Deshayes, 1863), *Tonicia* (*Lucilina*) *sueziensis* (Reeve, 1847) and *Chiton* (*Rhyssoplax*) *affinis* Issel, 1869. These were collected during the Napoleonic campaign to Egypt between 1798 and 1801 (Bouchet & Danrigal, 1982). Alas due to blindness Savigny never produced any text to accompany these figures. This task was very poorly executed by Audouin (1826), who didn't describe any of the species, all of which were still undescribed at the time the Savigny plates appeared. *Chiton sueziensis* (= *T. (L.) sueziensis*), described by Reeve in 1847, was the second chiton species to be described from material from the Red Sea (Gulf of Suez). Then in 1869 Issel recorded three species, again from the Gulf of Suez, one of which, *Chiton affinis*, was described as new.

After Issel many contributed to either the taxonomy (De Rochebrune 1882 & 1884; Sykes, 1907; Thiele, 1909-1910; Dupuis, 1917) or the distribution (M'Andrew, 1870; Sturany, 1904; Tillier & Bavay, 1905; Tomlin, 1927; Lamy, 1938; Moazzo, 1939 and Franc, 1956) of the the Red Sea chiton fauna. Leloup (1960) was the first to write a paper exclusively on Red Sea Polyplacophora. This was followed by a second paper (Leloup, 1980a), and in the IRSN there is a manuscript of a third paper based on the material collected by M. Mastaller in Jordan. In this manuscript he gave short descriptions of four species he thought were new: *Acanthochitona mastalleri*, *Notoplax aqabaensis*, *Tonicia costata*, and *Tonicia scabiosus*. Although this manuscript was never published, the names were used in Mastaller's thesis (1979) and by Vine (1986: 172). As both Mastaller and Vine gave no descriptions the names must be considered nomina nuda. Of all manuscript names only *A. mastalleri* proved a valid species, and was later described (Strack, 1989). Leloup's papers were accounts of small collections he received for study. Non critical lists of Red Sea Polyplacophora were made by Mienis (1974), Mastaller (1979) and Vine (1986), but no attempts were ever made to revise the complete Red Sea chiton fauna.

MATERIAL AND METHODS

This paper is mainly based on material the author collected during fieldwork in Egypt in 1987, where about 500 specimens were collected. Additional material was collected by several members of the Red Sea excursions organized by "Vita Marina" in the years 1988 and 1989. Much unrecorded material, together with some already published material, from several museum and private collections (see abbreviations) was also examined during this study. Furthermore type material from various institutions was studied in order to solve some of the taxonomic problems encountered. With a few exceptions the supraspecific classification of Kaas & Van Belle (1980) was followed in this paper.

All species are described and illustrated. Only short diagnostic descriptions are given for species adequately described in literature, occasionally supplemented with detailed

information not found in literature. The descriptions were based on actual studied material, although in several cases additional information from literature was used.

The dorsal elevation of chitons is described according to the method used by Kaas and Van Belle (1981: 7-8, fig. 1), except that here the height of elevation is expressed in the quotient of height : width of valve IV including the insertion plates (not only the parts covered by the tegmentum). Including the insertion plates in the measurements taken facilitates routine measuring, but differences of the results (quotients) between both ways of measuring are negligible.

Bibliography of each species is restricted to the original description of the species concerned and records from the Red Sea. The initial stage of bibliographical research was greatly facilitated by the use of a manuscript bibliography made by the late I. Yaron (Israel).

ABBREVIATIONS

- AS = A. van der Sman, Amsterdam, The Netherlands.
 BDA = B. Dell'Angelo, Formigine, Italy.
 BMNH = British Museum (Natural History), London, United Kingdom.
 CAS = California Academy of Sciences, San Francisco, U.S.A.
 ER = E. Rolan, Vigo, Spain.
 HLS = H.L. Strack, Rotterdam, The Netherlands.
 HUI = Zoological Museum, Hebrew University, Jerusalem, Israel.
 IRSN = Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium.
 JPB = J.P. Buis, Den Haag, The Netherlands.
 MNHN = Muséum National d'Histoire Naturelle, Paris, France.
 MZUF = Museo Zoologico dell'Università, Florence, Italy.
 RMNH = Rijksmuseum van Natuurlijke Historie (now Nationaal Natuurhistorisch Museum), Leiden, The Netherlands.
 SAM = South Australian Museum, Adelaide, Australia.
 TAU = Zoological Museum, Tel Aviv University, Tel Aviv, Israel.
 v = valve(s).
 ZMHU = Zoologisches Museum an der Humboldt Universität, Berlin, Germany.

SYSTEMATICS

Class POLYPLACOPHORA

Order NEOLORICATA

Suborder LEPIDOPLEURINA

Family LEPTOCHITONIDAE

Subfamily LEPTOCHITONINAE

Genus *Leptochiton* Gray, 1847

Subgenus *Leptochiton* s.s.

Leptochiton nierstraszi (Leloup, 1981)

(Pl. 1, Fig. 1; Pl. 7, Figs. 1-2)

Lepidopleurus (*Pilsbryella*) *nierstraszi* Leloup, 1981a: 27-28, fig. 13, pl. II, fig. 1.

Type: IRSN, IG 26.374 (holotype).

Type locality: Madagascar (= Malagasia), reef off Tuléar

Material examined: EGYPT:, Hurghada (HLS 1611/2v, ER/1v).

Description: The smallest chiton species living in the Red Sea. Maximal measurements 6 x 3.5 mm. Animal elongate oval in outline and rather elevated. Tegmentum sculptured with characteristic high elevated, round granules arranged in quincunx.

Girdle narrow and covered dorsally with small scales with 10-12 riblets and long, smooth, slender needles.

For a detailed description of the entire animal see Kaas & Van Belle (1985a: 130-132).

Description of the Red Sea valves: (Pl. 1, Fig. 1). Three intermediate valves from the Red Sea were studied of which the largest is a valve II. Valves white and measure 1.8 x 0.95, 1.7 x 0.7 & 1.5 x 0.6 mm (width x length). Dorsal elevation quotient varies between 0.4 and 0.42. Apophyses somewhat worn, small, more or less triangular and wide apart.

Tegmentum covered by well separated granules, with diameter of 40-50 μ m in valve II, up to 50-60 μ m in the two other valves. Contrary to the observations of Kaas & Van Belle (1985a: 130) there are no important size differences (diameter) between granules in different areas of the valves. Granules on jugal area are worn and hollow (Pl. 7, Fig. 2). Those along the posterior and side margins of the lateral areas very high elevated (up to 60 μ m), many narrower at the base than at the top, resulting in a remarkable, mushroom-like form (Pl. 7, Fig. 1).

Habitat: In Madagascar this species was found in coral reefs (under coral and in caves) at depths of 5 to 32 m. Their habitat in the Red Sea is unknown.

Distribution: In the Red Sea *L. nierstraszi* is only known from three loose valves found in shell grit at a depth of 2-20 m in Hurghada, Egypt. Hitherto this species was only known from Tuléar, Madagascar and St. Pierre, Réunion. The record from the northern Red Sea extends its known distribution considerably.

Remarks: Although only loose valves from the Red Sea could be studied, they are without doubt conspecific with *L. nierstraszi*. This species has a characteristic tegmental sculpture and in virtually all respects the valves match the descriptions by Leloup (1981a) and Kaas & Van Belle (1985a).

Subgenus *Parachiton* Thiele, 1909

Leptochiton (Parachiton) hylkiae n.sp.

(Pl. 1, Figs. 2-8; Pl. 2, Figs. 1-3)

Holotype: EGYPT:, south side Giftun Kebir Island (in front of Hurghada), 26.I.1987, HLS leg., length 9.8 mm, width 4.4 mm, flat and preserved in alcohol, colln. RMNH no. 9313.

Paratypes: EGYPT:, south side Giftun Kebir Island, 26.I.1987, HLS leg., colln. HLS no. 1954, 1 specimen (11.5 x 4.8 mm); Sharm el Sheik, 19.I. 1987, HLS leg., colln. HLS no. 1953, 1 specimen (11.8 x 5.2 mm, disarticulated); 16 km south of Hurghada, 23.VIII.1989, AS leg., colln. AS no. 651, 1 specimen (9.5 x 4.5 mm).

Diagnosis: Animal small, largest specimen (now disarticulated) 11.8 x 5.2 mm including girdle, elongate and almost parallel sided (Pl. 2, Fig. 4). Back rounded, dorsal elevation quotient 0.44 in 11.8 mm long paratype, somewhat less in other specimens. Intermediate valves not beaked, lateral areas not raised. Tegmentum sculptured with longitudinal chains of granules on central and lateral areas of intermediate valves and tail and head valve. Girdle narrow, dorsally covered with ribbed scales and long, smooth spines.

Description: Tegmentum yellowish with white markings and a darker coloured spot on each side of the jugum at the posterior sides of the valves. Largest paratype darker, greyish beige with lighter spots. Lateral areas, and their anterior edges in particular, brown, which

is visible through the articulamentum. Shell thin, apophyses small, more or less triangular and wide apart. Head valve semicircular with several conspicuous concentric growth lines (Pl. 1, Fig. 2), tegmentum with radiating chains of small granules.

Intermediate valves rectangular (Pl. 1, Fig. 3), posterior margins slightly convex, lateral areas not raised, back rounded, side slopes regularly convex. Tegmentum has rows of roundish granules, both on central and lateral areas (Pl. 1, Fig. 6) which are about 30–40 μm in diameter, sometimes separated but usually coalescing into longitudinal chains (Pl. 1, Fig. 7). Number of rows on central areas of valve 5 range between 68 (holotype) and 95 (largest paratype), rows with narrow interspaces. Valve VII is exceptionally large, slightly longer than valve II.

Tail valve long, about 1/5 of total length of shell, length about 3/5 of the breadth, mucro terminal (Pl. 1, Fig. 4), overhanging or almost overhanging posterior edge of tail valve, postmucronal slope steep and straight (Pl. 1, Fig. 5). Granules arranged as in other valves, antimucronal area with about 60 rows in holotype ranging up to 85 in largest paratype.

Girdle narrow, of similar colour or slightly darker than valves, dorsally densely covered with slightly curved elongate scales which measure 75–100 x 27–35 μm and are sculptured with 4–6 fine riblets (Pl. 2, Fig. 1). Long smooth cylindrical spines at margin. Similar spines, but longer, interspersed between dorsal girdle scales. Spines straight or curved and bluntly pointed, measuring 90–250 x 22–40 μm (Pl. 1, Fig. 8). Ventral scales flat and smooth, 50–65 x 22–30 μm , straight at base and pointed or bluntly rounded at top.

Radula of 11.8 mm long specimen has 47 rows of mature teeth. Major lateral teeth with round-topped tricuspid head, about 110 μm wide, middle teeth longest (Pl. 2, Fig. 3). Central teeth long and narrow, somewhat compressed in middle and without a distinct blade (Pl. 2, Fig. 2).

About 13–16 pairs of gills were observed, arrangement adanal without interspace and merobranchial, ranging from the anal area up to valve V.

Habitat: Under loose stones embedded in sand in very shallow water (0.2–1 m below mean low tide level).

Distribution: Known only from the northern Red Sea.

Remarks: This species is closely allied to *Leptochiton* (*Parachiton*) *ronaldi* Kaas & Van Belle, 1985 from the Andaman Islands. The holotype of this species, held in the BMNH (no. 1952.11.17.320), which in present state (flat dried and head valve missing) measures 8.8 x 3.9 mm, must have measured about 10 mm in living condition [certainly not 13 mm as stated by Kaas & Van Belle (1985a: 179)]. *L. (P.) hylkiae* can be distinguished from *L. (P.) ronaldi* by the sculpture of the lateral areas which have longitudinal rows of granules whereas the granules of *L. (P.) ronaldi* are arranged in quincunx. Furthermore the latter species has small striated spicules on the dorsal side of the girdle, which are not present in *L. (P.) hylkiae*. Instead *L. (P.) hylkiae* has large smooth spines which are absent in *L. (P.) ronaldi*. Although the closely related *L. (P.) ronaldi* is only known from the holotype, and no data exists about its infraspecific variation, the differences between the Andaman species and the specimens from the Red Sea are too important to consider them conspecific.

Also *Leptochiton* (*Parachiton*) *lifiuensis* (Hull & Risbec, 1931) from New Caledonia superficially resembles *L. (P.) hylkiae* but can be distinguished by its weaker granular sculpture, glossy surface, the many fine growth lines on the lateral areas and by different girdle elements.

The round-topped, tridentate head of the major lateral teeth of the radula of *Parachiton* is useful as taxonomic character in discriminating the subgenus *Parachiton* from *Leptochiton* s.s. In most cases the head of the major lateral teeth of *Leptochiton* s.s. has only one or two denticles, but when three are present, they are invariably sharply pointed, and not, as in *Parachiton*, bluntly rounded.

Etymology: *Leptochiton* (*Parachiton*) *hylkiae* is here named after Ms. Hylkje Eppinga who was my companion during my visit to Egypt and helped me with the fieldwork.

***Leptochiton* (*Parachiton*) sp.**

(Pl. 2, Figs. 5-7)

Material examined: EGYPT: Hurghada, VII-1987, J.L. Gonzalez & J. Uhia leg. (HLS 2031/1v).

Description (of tail valve): Dimensions; length 1.4 mm, width 2.4 mm. Mucro posterior, placed at 4/5 of the total valve length, postmucronal slope slightly concave. (Pl. 2, Fig. 6). Antemucronal area of tegmentum sculptured with about 52 rows of roundish to oval, small (diameter ca. 40 µm) granules (Pl. 2, Fig. 7). Postmucronal area with granules arranged in quincunx (Pl. 2, Fig. 5).

Habitat and Distribution: Only one tail valve found in shell grit from 2-20 m depth.

Remarks: This tail valve represents a species which can not be attributed with certainty to any of the known species of *Parachiton*. It differs from *L.(P.) hylkiae* in the position of the mucro and the postmucronal arrangement of the granules. It could be *Leptochiton* (*Parachiton*) *eugenei* Kaas & Van Belle, 1985, a species that was described from Madagascar (= Malagasia) or *Leptochiton* (*Parachiton*) *indecorus* Kaas & Van Belle, 1990, from Natal, South Africa. Both species are very acceptable options as they live in the same zoogeographical area (western Indian Ocean). But the lateral outline of the tail valves of these species considerably differ from the Red Sea tail valve. More material (complete specimens) will have to be found to clarify the exact taxonomic status of this second Red Sea *Parachiton* species.

Suborder ISCHNOCHITONINA

Family ISCHNOCHITONIDAE

Subfamily CALLOCHITONINAE

Genus *Callochiton* Gray, 1847

***Callochiton vanninii* Ferreira, 1983**

(Pl. 2, Fig. 8)

Lucilina sueziensis; Lamy, 1938: 88 (pars) (non *Chiton sueziensis* Reeve, 1847).

Callochiton laevis; Barash & Danin, 1977: 9 (non *Chiton laevis* Montagu, 1803); Leloup, 1980a: 6.

Callochiton septemvalvis; Barash & Danin, 1987: 83 (non *Chiton septemvalvis* Montagu, 1803).

Callochiton vanninii Ferreira, 1983: 259-266, figs. 11-19.

Type: MZUF no. 4098 (holotype)

Type locality: Somalia, Gesira.

Material examined: EGYPT: Merlin Point, 4 km south of Hurghada (HLS 1290/3); Hurghada (HLS 1961/5v, ER/2v); Gulf of Suez (MNHN/1); ISRAEL: Elat (TAU NS 8113/1); JORDAN: Al Aqabah (HLS 1048/2v, ER/1v); SUDAN: Pt. Sudan, Arons (BDA/1v).

Description: Animal small, largest specimen 12.5 x 7.9 mm (HLS 1290), oval. Back rounded to subcarinated, dorsal elevation quotient up to 0.38, side slopes convex, intermediate valves beaked, lateral areas raised. Girdle wide, dorsally clothed with long, sharply pointed spicules; small series of very long, curved needles on outer margin.

Valves: Tegmentum of live collected specimens from Egypt invariably dark red or brown red with small white spots on jugal area, and two lighter coloured bands lengthwise on

central areas on each side of the jugum, articulamentum dark red. Tegmentum of specimen from Israel grey white with pale rose tinge.

Tegmental surface has a faint granular appearance caused by aesthetes of about 10 μm in diameter. No ocelli can be observed in Egyptian specimens, although the specimen from Israel showed poorly developed, pigmented shell eyes under magnification. Entire shell surface sculptured with fine microstriation.

Apophyses wide, rounded and connected by a forwardly produced sinusal plate. Sinus shallow, poorly defined. Insertion plates well developed, slit formula 15/2/15 (Ferreira gives 16/2/16 for the holotype), slits deep, slit rays hardly perceptible. Eaves spongy.

Head valve semicircular, posterior margin widely V shaped.

Intermediate valves rectangular, anterior margin straight or slightly convex, posterior margin straight or slightly concave with protruding apex, posterior margin of valve II widely V shaped and projected forward. Lateral areas raised and well indicated.

Tail valve semicircular, mucro central or slightly anterior and pointed upwards, posterior slope straight to slightly concave.

Girdle wide, dark red with four white bands at sutures of valves I-II and VII-VIII, some minute black spotting on these bands caused by black pointed spicules. Girdle colour of Israeli specimen similar to tegmentum.

Girdle dorsally densely clothed with long, slender, straight, smooth, needle-like spicules, arranged in quincunx and pointed towards valves, away from the margin, 100-170 x 18-22 μm near margin up to 220 x 22 μm at mid-girdle.

Small linear series of longer, cylindrical, bent, smooth, colourless needles at regular intervals, from outer margin of girdle towards valves, 280-490 μm long, 14-24 μm wide, connected to girdle by small cusps. There are 45-54 (counted in two specimens measuring 10.1 and 12.5 mm) of these series, up to eight needles per series, very often needles are lost and only cusps remain.

Marginal fringe of small, slender, feather-like spicules, obliquely grooved, 80-100 x 12-16 μm , compressed at the base and flattened.

Ventral scales transparent, lanceolate, 60-75 x 20-26 μm .

Radula of 9.9 mm long specimen about 2.2 mm (c. 22% of specimen length), with at least 32 mature teeth (probably a few more as posterior part of radula is damaged). Central teeth broadly tulip-shaped, c. 50 μm long and c. 30 μm wide. Major lateral teeth with a tridentate head, 40-45 μm wide, all denticles sharply pointed, the central one slightly longer.

About 15-16 pairs of gills, which are adanal with interspace, holobranchial, and almost reaching anterior end of foot.

Habitat: Under dead coral and stones with red encrusting algae, in 0.5 - 1 m depth, probably also somewhat deeper.

Distribution: *Callochiton vanninii* is known from Somalia, Madagascar, Réunion and Mauritius. The present Red Sea records extend its known distribution considerably.

Remarks: Leloup (1980a: 6) identified a few Red Sea chitons as *Callochiton laevis* (Montagu, 1803) [= *Callochiton septemvalvis euplaeae* (O.G. Costa, 1829)]. These specimens (one of which I studied) certainly do not belong to this Mediterranean species. None of the Red Sea specimens have sulci on both sides of the central areas, which are so characteristic for *C. septemvalvis euplaeae*. Apparently the Red Sea specimens belong to the recently described species *C. vanninii*. There is however some discrepancy between the Red Sea specimens and the original description of *C. vanninii*. The Red Sea specimens have well defined and raised lateral areas, relatively longer dorsal girdle elements and in two specimens shell eyes were visible. As the infraspecific variation of *C. vanninii* is unknown, these differences alone do not warrant separate specific status, but to facilitate future study I have given a full description of the Egyptian Red Sea specimens.

Subfamily LEPIDOCHITONINAE

Genus *Lepidochitona* Gray, 1821*Lepidochitona monerosatoi* Kaas & Van Belle, 1981

(Pl. 2, Fig. 9)

Middendorffia caprearum; Barash & Danin, 1977: 10 (non *Chiton caprearum* Scacchi, 1836); Leloup, 1980a: 11, pl.2, fig 2.

Lepidochitona monerosatoi Kaas & Van Belle, 1981: 23-26, figs. 57-72, map 3.

Lepidochitona corrugata Barash & Danin, 1987: 83 (non *Chiton corrugatus* Reeve, 1848).

Type: RMNH, no. 55386 (holotype).

Type locality: France, Alpes Maritimes, Port de l'Olivette.

Material examined: ETHIOPIA:, Dahlak Archipelago, Museri Island (TAU 65.0022/1).

Description: A small species, up to ca. 12 mm long, elongate oval, rather elevated and more or less carinated. Head valve with about eight faint undulations, tegmentum sculptured with coarse granules which are arranged in quincunx in head valve, tail valve and lateral areas of intermediate valves. Granules in curved series on pleural areas. Tail valve small, mucro central. Girdle dorsally covered with small, short, rounded spicules, interspersed by characteristic small bundles of curved, long spines. Ventral scales conical, flat, base rounded, tip pointed. For a more detailed description see Kaas & Van Belle (1981: 23-26 & 1985b: 99-102).

Remarks: Leloup (1980a: 11) recorded two specimens identified as the Mediterranean species *Middendorffia caprearum* (Scacchi, 1836) [= *Lepidochitona corrugata* (Reeve, 1848)] from the Red Sea. After studying one of the two specimens, and as can be seen from fig. 2 in Leloup's paper, the species in question proved to be *Lepidochitona monerosatoi* Kaas & Van Belle, 1981. *L. monerosatoi* was only recently described from Mediterranean specimens, and it is therefore difficult to ascertain its origins. The remark of Kaas & Van Belle (1981: 25) "it is hard to understand why it was not discovered earlier, as within the past few years several specimens were brought to light", suggests it could be a recent Lessepsian migrant. On the other hand the single record from the Red Sea and the relative abundance of Mediterranean records indicates a Mediterranean origin of the species. Hitherto no verified pre-1869 (the inauguration year of the Suez Canal) material has turned up. If the Greek record of *Chiton polii* Philippi, 1836 by Forbes (1844: 135) should refer to *L. monerosatoi* rather than *L. corrugata* (see Strack, 1988: 77), this could be the ultimate proof of its Mediterranean origin, and that would make *L. monerosatoi* one of the few true Antillessepsian migrants.

Subfamily ISCHNOCHITONINAE

Genus *Lepidozona* Pilsbry, 1892*Lepidozona luzonica* (Sowerby, 1842)

(Pl. 3, Fig. 1)

Chiton luzonicus Sowerby, 1842: 104.

Lepidopleurus concharum De Rochebrune, 1884: 33; Ferreira, 1983: 254.

Callistochiton concharum; Thiele, 1910: 85-86, pl. 8, figs. 55-56.

Lepidozona luzonica; Kaas & Van Belle, 1990: 51.

Type: BMNH no. 1979. 175/1 (lectotype designated by Kaas & Van Belle, 1987: 245).

Type locality: Philippines, Luzon Island, Sorsogon.

Material examined: RED SEA: (MNHN/1 = lectotype *L. concharum*).

Description of lectotype of *L. concharum* (colln. MNHN): Animal small, 9.2 x 5.7 mm, flat dried, glued on bivalve, carinated, colour of tegmentum and girdle dirty white. Head valve with ca. 32 granulose fine ribs, 4-5 ribs on lateral areas of intermediate valves and ca. 27 ribs on tail valve. Central areas of intermediate valves with 13-14 granulose ridges on each side. Head valve is decidedly broader than tail valve. Mucro anterior, postmucronal slope almost straight. Dorsal girdle scales about 160 µm wide, finely ribbed.

Habitat: Specimens of *L. luzonica* from Qatar, Arabian Gulf, were collected on dead shells in depths of 10-20 meters.

Distribution: Philippines, Malaysia, Singapore, Java, Arabian Gulf, and the Red Sea.

Remarks: This specimen matches the short original description made by De Rochebrune (1884) and apparently the same specimen was studied by Thiele (1910: 85-86, pl. 8, figs. 55-56). It is hereby designated as lectotype.

Kaas & Van Belle (1990: 51) also studied the same syntype of *L. concharum* and came to the conclusion that it is a specimen of *Lepidozona luzonica* (Sowerby, 1842). A characteristic contradicting this identification is the fact that the head valve is considerably wider than the tail valve, whereas in *L. luzonica* both valves are of about equal size [see figured lectotype of *L. luzonica* in Kaas & Van Belle, 1987: fig 111 (1)]. The lectotype of *L. concharum* is glued on the inside of a valve of the Australian bivalve *Circe weedingi* (Cotton, 1934) and is the only Red Sea record known, therefore Kaas & Van Belle rejected Rochebrune's locality. As *L. luzonica* does occur in the Western Indian Ocean, where it was found in Bahrain, Qatar and the United Arab Emirates (Kaas & Van Belle, 1988: 118-120), specimens of this species could be expected to occur in the southern Red Sea. Furthermore the lectotype seems to have been glued to the Australian bivalve after Thiele examined it, as he extracted the radula for research and did not mention the specimen being glued to a shell. Therefore I prefer to retain *L. luzonica* as a species that occurs in the Red Sea.

Genus *Ischnochiton* Gray, 1847

Ischnochiton yerburyi (E.A. Smith, 1891)

(Pl. 3, fig. 2; Pl. 7, fig. 3)

Chiton (Ischnochiton) yerburyi E.A. Smith, 1891: 420, pl. 33 fig. 6.

Ischnochiton yerburyi; Leloup, 1960: 35-36, fig. 5; Mastaller, 1979: 25, 238, 242, 247 & 254; Mergner, 1979: tabs. 4 & 6; Leloup, 1980a: 10; Ferreira, 1983: 251-254, figs. 1-2; Kaas & Van Belle, 1990: 124-127, Map 21.

Ischnochiton sp.; Mastaller, 1978: 128 (after Yaron MS.).

Type: BMNH, 1888.4.9.345 (holotype).

Type locality: Jemen, Aden.

Material examined: EGYPT: 5 km south of Ras Adabiya (HLS 1397/5v); Na'ama (HLS 1247/6); Sharm el Sheik (HLS 1248/22); Hurghada (ER/1v); Merlin Point, 4 km south of Hurghada (HLS 1246/1); 7 km south of Hurghada (AS 661/2); Giftun Kebir Island (AS 711/1); El Qalawa, 25 km south of Safaga (HLS 1624/1); JORDAN: Al Aqabah, (HLS 1049/3v); Al Aqabah (HUJ 30874/1, HUJ 20683/1); 11-12 km south of Al Aqabah (KBIN IG 26.374/3); ETHIOPIA: Dahlak Archipelago, Difuein Island (BDA/1v).

Description: Small to moderate size, largest specimen examined, 22.8 mm long (HLS 1246). Valves subcarinated, tegmentum with characteristic reticulate, thimble-like sculpture. Colour white, cream or buff variegated with green, brown or dark grey or with small spots

of same colour. Girdles of 10-12 mm long specimens have finely ribbed scales up to ca. 100 μm wide, largest specimen examined with scales up to 160 μm wide. Outer margin of dorsal side of girdle interspersed with long (up to 220 μm), slender, smooth, slightly bent, cylindrical needles stalked on cusps (Pl. 7, Fig. 3), not mentioned in earlier descriptions of this species.

A detailed description of *I. yerburyi* is given by Kaas and Van Belle (1990: 124-127), the holotype was figured by Ferreira (1983: figs. 1-2).

Habitat: Most specimens were found under stones and dead coral embedded in sand between low tide and 2 m depth.

Distribution: Western Indian Ocean. From the Red Sea and the Arabian Gulf in the north to Mozambique in the south. The easternmost records are from Pakistan.

Subfamily Callistoplacinae
Genus *Callistochiton* Dall, 1879

***Callistochiton adenensis* (E.A. Smith, 1891)**
(Pl. 3, Fig. 3)

Chiton (*Callistochiton*) *adenensis* E.A. Smith, 1891: 421, pl. 33, fig. 7.

Callistochiton adenensis; Leloup, 1952: 30; Leloup, 1953: 1-3, fig. 1.

Type: BMNH (holotype).

Type locality: Yemen, Aden.

Material examined: REDSEA: no exact locality known, F.P. Jousseume leg. (MNHN/2, HLS 1995/1).

Description: Animal medium sized, largest specimen examined 28 mm (Djibouti, MNHN). Colour uniform light brown or orange. Anterior valve sculptured with 22-30 nodulous radial ribs, posterior valve with 30-42 fine, nodulous ribs. Intermediate valves with 2 (sometimes 3) strong ribs. Central areas with numerous longitudinal ribs. Girdle dorsally covered with oval, wide, short, ribbed, imbricating scales.

For a more detailed descriptions see Thiele (1910: 84-85), Leloup (1953: 1-3) and Kaas & Van belle (1988: 120-121).

Habitat: The only habitat data was given by Jousseume (1894: 102), who found it living on madrepora corals.

Distribution: *Callistochiton adenensis* is known from Djibouti, Yemen (Aden), Oman and the Red Sea. No specific locality is known of the available Red Sea material, but as the species does not occur in the northern Red Sea and as Jousseume, the collector of this material, did most of his collecting in Djibouti and Yemen it must have originated from the southern part of the Red Sea.

Family SCHIZOCHITONIDAE
Subfamily SCHIZOCHITONINAE
Genus *Schizochiton* Gray, 1847

***Schizochiton jousseumei* Dupuis, 1917**
(Pl. 3, Figs. 4-7; Pl. 7, Figs. 4-7)

Schizochiton jousseumei Dupuis, 1917: 4-6, figs. 1-3; Zeidler & Gowlett, 1985: 114-115.

Type: MNHN (holotype).

Type locality: Yemen, Perim (= Barim Island).

Material examined: YEMEN: Perim, F.P. Jousseaume leg. (MNHN/1 = holotype, SAM/1v); RED SEA: no exact locality known, F.P. Jousseaume leg. (SAM/3).

Description: The dried, partly disarticulated and curled holotype (Pl. 3, Figs. 4-5) now measures 8.5 mm in length, but must have measured about 20 mm or somewhat more in life. Shell elongate oval, moderately elevated. Insertion plate of head valve well developed and fluted on outside; less developed in intermediate valves, thickened, fluted on outside and directed forward in tail valve. Slit formula 8/2/6, of which two slits situated at both posterior ends of head valve are very small. Intermediate valves also have a very small additional slit. Jugal sinus rather narrow with pectinated sinusal laminae connecting apophyses. Colour of tegmentum white mottled with dark grey and brown.

Valves: Head valve sculptured with six radial ribs, each rib with a single linear series of large shell eyes. Interspace between ribs with wavy or zig-zag ridges. Lateral areas of intermediate valves small, and separated from central areas by a nodulous rib with a single ray of shell eyes. Central areas with series of more or less longitudinal ridges near lateral areas, but largest part of central area with reticulate sculpture, only a narrow, smooth jugal tract remains. Tail valve triangular, antemucronal area sculptured like intermediate valves, mucro terminal and pointed upwards, postmucronal area with characteristic, wide fissure and three ribs similar to those on head valve on each side of the fissure. Hind slope directed forward.

Girdle very wide with fissure splitting posterior anal area, dorsally densely covered with small (50-80 μ m long) striated spicules, interspersed with large, finely striated, strongly curved spines, measuring 270-420 x 40-60 μ m.

Additional data from specimen from Socotra Island, Yemen, Gulf of Aden (colln. Van Belle, part of girdle in colln. HLS 1996): Estimated length of specimen ca. 50 mm, which is considerably larger than the holotype. Tegmentum of central areas of valves II-VIII with reticulate sculpture all over, also on jugal area (Pl. 3, Fig. 6).

Girdle dorsally covered with small, pointed (tips often broken), distally striated spicules up to ca. 110 μ m in length (Pl. 7, Fig. 6), interspersed with large, conical, pointed, finely striated spines, up to 460 μ m in length (Pl. 7, Fig. 7). Marginal spicules cylindrical, smooth, slightly curved, 250-280 μ m long. Ventral spicules elongate, ribbed, rounded at the tip or bluntly pointed, 60 - 70 μ m long (Pl. 7, Fig. 5).

Radula 10.3 mm long, with 52 rows of mature teeth. Central tooth with spoon-shaped blade, 55 μ m wide. Major lateral tooth with tridentate cusp, outer denticle smallest, inner two about equal in length (Pl. 7, Fig. 4).

Gills abanal and merobranchial, ranging from anterior end of valve V up to anterior end of valve VIII, 27 gills on each side.

Habitat: Unknown, but probably similar to that of its nearest relative *Schizochiton incisus* (Sowerby, 1841), which lives in crevices in dead coral and under stones, lower intertidal to a few meters depth.

Distribution: Only known from the type locality Barim Island (Red Sea), Yemen (Gulf of Aden) and Socotra Island (Van Belle & Wranik, 1991: 370).

Remarks: *Schizochiton jousseaumei* is a distinctive species and positive identification should pose no problems. It can be easily differentiated from *S. incisus* by the reticulate sculpture on valves II-VIII and by the postmucronal slope which is not steep as in *S. incisus* but projected forward.

In the SAM collection there are three complete specimens and a head valve of this species. These originated from the Dupuis collection which was given to Ashby by Dupuis. Although the specimens are labelled "type", they are not, as the original description was based on a single, ca. 8 mm long specimen. The SAM specimens measure 10.5 x 5.1, 10.7

x 7.1 and 16.6 x 9.2 mm and are therefore too large to include the holotype. The MNHN specimen fits the description better and must be regarded as the holotype.

Family CHITONIDAE
Subfamily CHITONINAE
Genus *Chiton* Linnaeus, 1758
Subgenus *Chiton* s.s.

***Chiton peregrinus* Thiele, 1910**
 (Pl. 3, Fig. 8)

Chiton peregrinus Thiele, 1910: 90, pl. 9, figs. 32-37; Bullock, 1972: 238-239, pl. 44, figs. 1-2 & 10.

Chiton lamyi Dupuis, 1918: 7-8.

Type: ZMHU (syntypes).

Type locality: South Africa, Algoa Bay (in error), corrected by Bullock (1972: 238) in Yemen, Aden.

Material examined: YEMEN:, Barim Island (= Perim) (MNHN/2, SAM/1).

Description: Large chiton, maximal size 70 x >40 mm (Kaas & Van Belle, 1988: 121), but generally about 30 mm in length. Older specimens often eroded, young specimens have tegmentum with fine, somewhat wavy granulose sculpture, lateral areas with two radial ribs. Head valve and postmucronal area of tail valve weakly nodulous. Colour greyish green or reddish brown. Girdle dorsally paved with large, smooth scales.

See for a more detailed description of shell morphology Winckworth (1930: 78-80, pl. 8b), and for girdle armature and radula Thiele, 1910 (90, pl. 9, figs. 32-37) and Kaas & Van Belle (1988: 121, figs. 28-30). Bullock (1972: pl. 44, figs. 1-2 & 10) gives good illustrations of separate valves.

Habitat: *C. peregrinus* is an intertidal rock dwelling species.

Distribution: Northwestern Indian Ocean. From northwest India, Pakistan, Gulf of Oman, Arabian Gulf, Gulf of Aden and the entrance of the Red Sea.

Subgenus *Tegulaplax* Iredale & Hull, 1926

***Chiton (Tegulaplax) hululensis* (E.A. Smith, 1903)**
 (Pl. 3, Fig. 9; Pl. 7, Figs. 8-9)

Ischnochiton hululensis E.A. Smith, 1903: 619, pl. 36, figs. 3-6; Ferreira, 1983: 290-291.

Chiton (Clathropleura) platei; Thiele, 1910: 92, pl. 9, figs. 46-48; Leloup, 1960: 37-38, fig. 3; Mastaller, 1979: 26, 238, 242 & 259; Leloup, 1980a: 7.

Lucilina sueziensis; Lamy, 1938: 88 (pars) (non *Chiton sueziensis* Reeve, 1847).

Callistochiton heterodon; Mastaller, 1978: 126 (non Pilsbry, 1893) (after Yaron MS.).

Chiton (Tegulaplax) hululensis; Kaas, 1979: 866-868 (synonymy).

Type: BMNH, 1903.9.17.27 (holotype).

Type locality: Maldives Islands, Hulule Island.

Material examined: EGYPT:, Na'ama (HLS 1254/2); Merlin Point (HLS 1255/1); south side Giftun Kebir Island (HLS 1256/2); Giftun el Saghir (HLS 1851/1); Between Giftun el Kebir and Giftun el Saghir (BDA 3042/1); El Qalawa (RMNH/1); Hurghada (HLS 1612/2v, ER/2v); Abu Mingar Island (AS 576/1); Gulf of Suez, (MNHN/1);

ISRAEL:, Elat (HJ 20688/1); **JORDAN:**, Al Aqabah, (HLS 863/2 & 6v, ER/2 & 4v); 11-12 km south of Al Aqabah (KBIN IG 26.374/1); **SUDAN:**, Sanganeb Reef (BDA/1v); Shabruni Reef (BDA/1v).

Description: Small to medium size, largest Red Sea specimen studied 26.5 mm (colln BDA 3042). Colour mostly pink or violet with white, yellow, brown or pale green blotches. Lateral areas and end valves with irregular, wavy, concentric riblets. Central areas and antemucronal area of tail valve smooth, except for micro-sculpture and growth lines. Girdle dorsally clothed with scales, ca. 250-400 μ m wide, with 12-15 ribs.

For a more detailed description of the girdle elements see Leloup (1960: 38, fig. 3) and Kaas (1979: 867, pl. 2, figs. 13-17).

Radula of approximately 22 mm long specimen (colln HLS 1851) has 44 rows of mature teeth. Central tooth (Pl. 7, fig. 8) slender with small blade (30 μ m wide), cusp major lateral tooth (Pl. 7, fig. 9) discoid and bluntly pointed at the top, 150 - 160 μ m wide.

Habitat: Intertidal pools to 3 m depth (occasionally deeper), under stones and dead coral embedded in sand.

Distribution: Indo-West Pacific species. Southernmost record in the west is Mozambique, in the east (Pacific) Lord Howe Island. Northern limit is the northern Red Sea and Mediterranean coast of Israel.

Remarks *C. (T.) hululensis* is one of the few widely distributed Indo-Pacific chiton species occurring in the Red Sea. Remarkable is the presence of this species in the Mediterranean, where two specimens were found (in 1934 and 1971) in Israel (Barash & Danin, 1977: 13, fig. 9). These Mediterranean records constitute the only known cases of Lessepsian migration of chitons.

Subgenus *Rhyssoplax* Thiele, 1893

Chiton (Rhyssoplax) affinis Issel, 1869

(Pl. 4, Fig. 1)

Chiton squamosus; Audouin, 1826: 148-149 (non *Chiton squamosus* Poli, 1791).

Chiton affinis Issel, 1869: 234-235; Caramagna, 1888: 146; Sturany, 1904: 267; Sykes, 1907: 34; Pallary, 1926: 30-31, figs. 8-9; Moazzo, 1939: 217; Yaron, 1973: 15-17; De Brauwer *et al.*, 1981: 165; Bouchet & Danrigal, 1982: 11, fig. 51.

Lophyrus affinis; M'Andrew, 1870: 444.

Lepidopleurus bottae De Rochebrune, 1882: 192.

Callistochiton heterodon var. *savigny* Pilsbry, 1893: 277, fig. 16; Rees & Stuckey, 1952: 184; Bouchet & Danrigal, 1982: 15.

Chiton (Clathropleura) affinis; Thiele, 1910: 91, pl. 9 figs. 41-44.

Chiton decoratus; Tillier & Bavay, 1905: 176 (non *Callistochiton decoratus* Carpenter in Pilsbry, 1893).

Chiton olivaceus var. *affinis* Leloup, 1952: 27-31, fig. 11, pl. 4, fig. 4; Leloup, 1960: 36-37; Fishelson, 1971: 122; Leloup, 1980a: 7.

Lorica (Callistochiton) heterodon; Franc, 1956: 20 (non *Callistochiton heterodon* Pilsbry, 1893).

Chiton olivaceus affinis; Mastaller, 1979: 26.

Chiton olivaceus; Leloup, 1980a: 7; Barash & Danin, 1987: 83.

Rhyssoplax affinis; Ferreira, 1983: 268-270, figs. 22-24.

Type: MNHN (lectotype, designated by Ferreira, 1983: 268).

Type locality: Gulf of Suez.

Material examined: EGYPT: 5 km south of Ras Adabiya (HLS 1396/5v); Na'ama (HLS 1263/4); Sharm el Sheik (HLS 1264/12); Merlin Point, (HLS 1265/33, AS 571/1); 6 km north of Hurghada (HLS 1266/28); Hurghada (HLS 1613/14v, ER/9v); 7 km south of Hurghada (RMNH/2, AS 649/1); 16 km south of Hurghada (HLS 1850/2); Giftun Kebir Island (AS 658/2); between Giftun el Kebir and Giftun el Saghir (BDA 3041/1); Abu Mingar Island (AS 580/1); Safaga (AS 486/2); 10 km south of Safaga (AS 583/1); Dhow Anchorage, 18 km south of Safaga (AS 586/1); Quseir (RMNH/1, AS 663/1); 20 km south of Hurghada (RMNH/1); Sharm el Naga (RMNH/3); Suez (MNHN/3); Abulat Island (MNHN/2); El Tor = El Tur? (ZMHU/2); ISRAEL: Elat, (HUJ 20682/6v, HUJ 20687/1v, JPB/1); Gulf of Elat (JPB/6); JORDAN: Al Aqabah (HLS 813/2 & 32v, ER/2 & 33v); 11-12 km south of Al Aqabah (KBIN/1). SAUDI ARABIA: Yanbu (AS 80/1); SUDAN: Sanganeb Reef (BDA/1v); Pt. Sudan, Arons (BDA/1v); ETHIOPIA, Mits'iwa (= Massawa) (MNHN/2, JPB/1); Dahlak Archipelago, Difuein Island (BDA/1v).

Description: Largest specimen examined 25.5 mm (AS 663), but usually between 14 and 18 mm. Colour variable, generally cream with grey, yellow, brown or red, the latter colours sometimes predominating. End valves with strong radial ribs and lateral areas with 2-3 such ribs, interstices pitted. Central areas and antemucronal area with longitudinal sulci not reaching anterior margin of valve near jugum. Girdle dorsally paved with imbricated scales, 220-350 μ m wide, with 6-10 well defined ribs.

Detailed descriptions of girdle were given by Leloup (1952: 29, fig. 11 and 1955: 4, fig. 2) and of radula by Ferreira (1983: 269) and Kaas & Van Belle (1988: 122, fig. 40).

Habitat: Under stones and dead coral in lower intertidal pools to 1-2 m depth, occasionally deeper.

Distribution: Red Sea, Somalia, Gulf of Aden, Gulf of Oman and the Arabian Gulf.

Remarks: It is hard to understand why this species was so long confused with the Mediterranean *Chiton (Rhyssoplax) olivaceus* Spengler, 1797. The differences between the two species are many (Yaron, 1973) and both species can easily be separated.

Chiton (Rhyssoplax) heterodon (Pilsbry, 1893)

(Pl. 6, Figs. 4-6)

Callistochiton heterodon Pilsbry, 1893: 276-277, pl. 60, figs. 11-15.

Chiton heterodon; Thiele, 1910: 91; Leloup, 1955: 1-4, figs. 1-2.

Non *Lorica (Callistochiton) heterodon*; Franc, 1956: 20; *Callistochiton heterodon*; Mastaller, 1978: 128; Mastaller 1979: 26; Vine, 1986: 172 and *Callistochiton heterodon* var. *savigny*; Rees & Stucky, 1952: 184 (= *Chiton (Rhyssoplax) affinis* Issel, 1869).

Type: Academy of Natural Sciences of Philadelphia, no. 118696 (holotype).

Type locality: Red Sea.

Material examined: RED SEA: (ZMHU/1); DJIBOUTI: Gulf of Aden? (RMNH/1).

Description: Medium sized chiton, to 16 mm in length. Colour whitish with olive, orange-red and black spots. Head valve (Pl. 6, Fig. 4) with 11-20, tail valve (Pl. 6, Fig. 6) with 11-12, and lateral areas of intermediate valves with 3-4 granulose ribs and with dentated posterior margin. Central areas of intermediate valves with 11-15 somewhat granulose longitudinal riblets on each side, which reach anterior margin of valve (Pl. 6, Fig. 5). Dorsal surface girdle paved with imbricating scales, 320-370 x 180-250 μ m, with 9-12 strong ribs (Pl. 6, Fig. 3).

A detailed description of *C. (R.) heterodon* was given by Leloup (1955). The holotype was illustrated by Ferreira (1983: fig. 23).

Habitat: Unknown.

Distribution: Known from the Red Sea and the Gulf of Aden.

Remarks: Ferreira (1983: 270) supported Pilsbry's allocation to *Callistochiton*, and minimized the importance of the pectinated insertion plates of *C. (R.) heterodon*. This is one of the main characters of the genus *Chiton*, and certainly not of *Callistochiton*. I fully agree with Thiele's (1910: 91) conclusions and generic assignment. This species has strong affinities with *Chiton (Rhyssoplax) affinis*, and undoubtedly belongs to the same genus and subgenus.

It differs from *C. (R.) affinis* in the stronger and more granulose radial ribs in end valves and lateral areas, and in having more numerous and granulose longitudinal riblets on central areas of intermediate valves. The present study could not acknowledge the following differential characters given by Ferreira (1983: 270): "(v) posterior valve inflated with strongly convex postmucro, (vi) insertion teeth short and blunt, with tendency towards thickening at edges, (vii) articulamental slits corresponding with tegmental ribs, and (viii) much larger girdle scales, up to 350 μ m long". Characters (v) and (viii) were also observed in typical specimens of *C. (R.) affinis*. Characters (vi) and (vii) were wanting in *C. (R.) heterodon* specimens I studied.

***Chiton (Rhyssoplax) maldivensis* (E.A. Smith, 1903)**

(Pl. 4, Fig. 2, Pl. 7, Figs. 10-16)

Ischnochiton maldivensis E.A. Smith, 1903: 596, 619-620, pl. 36, figs. 7-10.

Chiton (Clathropleura) rueppelli Thiele, 1910: 91, pl. 9, fig. 45.

Chiton corallinus; Leloup, 1960: 36 (non *Lepidopleurus corallinus* Risso, 1826); Barash & Danin, 1977: 12; Leloup, 1980a: 7; Barash & Danin, 1987: 84.

Chiton canariensis; Mastaller, 1979: 26, 238, 242 & 254 (non *Chiton canariensis* D'Orbigny, 1839).

Type: BMNH no. 1903.9.17.26 (holotype).

Type locality: Maldive Archipelago, Felidu Atoll.

Material examined: EGYPT: Na'ama (HLS 1291/2); Sharm el Sheik (HLS 1292/3); Giftun el Kebir (AS 659/1); between Giftun el Kebir and Giftun el Saghir (BDA 3039/2v); 16 km south of Hurghada (AS 669/1v); ISRAEL: Elat (TAU NS 7931/1); JORDAN: Al Aqabah (HLS 862/4 & 10v, ER/1 & 6v); 11-12 km south of Al Aqabah (KBIN/1); SUDAN: Sanganeb Reef (BDA/2v, HLS 1962/1v); Suakin Lagoon (BDA/1v); ETHIOPIA: Dahlak Archipelago, Condabilu Island (HLS 577/1); RED SEA: no exact locality known (ZMHU/2 = lectotype and paralectotype of *Chiton (Clathropleura) rueppelli* Thiele, 1910).

Description: Animal small, largest specimen examined 16.5 mm long (AS 659), usually about 10-13 mm. Elongate oval, back somewhat rounded to subcarinated, high elevated, dorsal elevation 0.42 - 0.44. Slit formula 8/9-1-10/13. Colour generally cream variegated with grey and brown, sometimes green with brown and white blotches on jugal area, brown with white spots or completely white.

Head valve smooth except for concentric growth lines and micro sculpture. Intermediate valves rectangular, posterior margin more or less straight with small apex. Central areas sculptured with 6-12 sulci, number of sulci increases with length of specimen. About half of sulci on outer edges of central area reach anterior margin of valve, towards the jugum they do not, jugal area smooth. Lateral areas raised and well marked, smooth except for few growth lines. Apophyses wide, jugal sinus relatively narrow, pectinated. Antemucronal

area of tail valve sculptured like central areas of intermediate valves, with 5-8 sulci on each side, postmucronal area smooth except for growth lines. Mucro central or somewhat posterior, mucronal slope slightly concave in small specimens to slightly convex in larger specimens.

Girdle dorsally clothed with oval, imbricating scales, 180-230 μm wide, with ca. 20 faint, sometimes hardly perceptible riblets (Pl. 7, Figs. 15-16). Marginal spicules short, 80-100 μm long, 20 μm thick, tip rounded, obliquely grooved in two directions (Pl. 7, Fig. 13). Very delicate stalked needles, to 130 μm long (including stalk), 4-8 μm thick interspersed between spicules and marginal dorsal scales (Pl. 7, Fig. 12). Girdle ventrally paved with smooth, elongate rectangular scales, 50-60 x 10-15 μm (Pl. 7, Fig. 14).

Radula of 13.1 mm long specimen has 39 rows of mature teeth. Central tooth narrow and inconspicuous with small cusp (Pl. 7, Fig. 10). Major lateral tooth with broad, discoid cusp, 90 μm wide (Pl. 7, Fig. 11). Cusp with small tubercle on outer margin.

Gills holobranchial, adenal with interspace. In four specimens, between 12 and 14.5 mm long, 20-23 gills per side were counted.

Habitat: Under stones and dead coral, between low water mark and 1 m depth.

Distribution: Outside the Red Sea *C. (R.) maldivensis* is only known from Djibouti (1 specimen in colln. MNHN, F.P. Jousseau leg.), Yemen and the Maldivé Archipelago.

Remarks: Thiele (1910) first recorded this species from the Red Sea, and described it under the name *Chiton (Clathropleura) rueppelli* [= *Chiton (Rhyssoplax) rueppelli*]. Recently Van Belle & Wranik (1991: 374) synonymized *C. (R.) maldivensis* and *C. (R.) rueppelli*.

I have studied the holotype of *C. (R.) maldivensis* and the syntypes of *C. (R.) rueppelli* (colln ZMHU). The former is a dried and flat preserved specimen, pasted on a piece of black paper, soft parts missing, with valves 1, 2, 3 and 8 disarticulated, 7 mm long and 3.8 mm wide. The colour is pale orange-red with a few small white spots. The syntypes of *C. (R.) rueppelli* are two dried (soft parts present) specimens; one is slightly curled, 6.7 x 4 mm, valves 1, 5 and 8 disarticulated and dorsal girdle scales missing; the second specimen is flat, 8.8 x 4.1 mm, with part of dorsal girdle scales still present. This larger specimen is apparently the one figured by Thiele (1910: pl. 9, fig. 45) and it is here designated as lectotype.

In all respects the holotype of *C. (R.) maldivensis* is identical with the syntypes of *C. (R.) rueppelli* and other specimens from the Red Sea, except for the girdle scales which, although the same in size (170 - 210 μm wide), have only 14 - 16 riblets, whereas specimens from the Red Sea have about 20. In spite of this discrepancy the synonymy of both taxa seems justified.

This species was misidentified several times by Leloup and recorded by him under the names *Chiton (Rhyssoplax) corallinus* (Risso, 1826) (Leloup, 1960, 1980a) and *Chiton (Rhyssoplax) canariensis* d'Orbigny, 1839 (Mastaller, 1979 after Leloup MS). The former is a well known Mediterranean species and the latter is an equally well known West African species. Both have little in common with *C. (R.) maldivensis*, except that all have smooth anterior valves, lateral areas and postmucronal areas of tail valves. *C. (R.) maldivensis* is more related to the Mediterranean species *Chiton (Rhyssoplax) phaseolinus* Di Monterosato, 1879, but differs from this species by: a) smaller (15-20 %) dorsal girdle scales, b) less elevated valves, c) less rounded back, and d) sulci of central areas somewhat deeper and longer.

Subfamily ACANTHOPLEURINAE

Genus *Acanthopleura* Guilding, 1829*Acanthopleura vaillantii* de Rochebrune, 1882

(Pl. 4, Figs. 3-4)

? Chiton testudo Spengler, 1797: 78.*Chiton* sp.; Audouin, 1826: 147 (ex Savigny, 1817: pl. 3 fig. 4).*Chiton spiniger*; Vaillant, 1865: 110; Fischer, 1870: 168; Pagenstr cher, 1877: 1?&61; Tillier & Bavay, 1905: 176.*Acanthopleura brevispinosa*; Blanford, 1870: 468 (non *Chiton brevispinosus* Sowerby, 1840)(not seen); Plate, 1897: 167-170, pl. 11, figs. 111-112; Leloup, 1980b: 8-11, figs. 5 & 7, map 1.*Acanthopleurus spiniger*; M'Andrew, 1870: 444.*Acanthopleura vaillantii* (sic) De Rochebrune, 1882: 192.*Chiton (Acanthopleura) spiniger*; E.A. Smith, 1891: 420.*Acanthopleura spiniger*; Sturany, 1904: 267; Leloup, 1952: 41-44; Soliman & Iskander, 1982: 205-210.*Acanthopleura spinigera*; Sykes, 1907: 34; Pallary, 1926: 28 (ex Savigny, 1817: pl. 3 fig. 4); Nierstrasz, 1905: 99-101; Tomlin, 1927: 291; Gruvel & Moazzo, 1933: 143; Horst & Schepman, 1908: 526; Lamy, 1938: 88; Moazzo, 1939: 219; Franc, 1956: 21.*Acanthopleura haddoni* Winckworth, 1927: 206p pl. 28 figs. 1-4; Rees & Stuckey, 1952: 185; Leloup, 1960: 38-39; Safriel & Lipkin, 1964: 188; Biggs, 1965: 337; Fishelson, 1971: 126, fig. 4 & 8(3); Mergner & Schuhmacher, 1974: 330; Pearse, 1978: 92-95, 98-100, fig. 2; Mastaller, 1978: 128; Mastaller, 1979: 26, 227, 231 & 235, fig. 12; Leloup, 1980a: 6; Ayal & Safriel, 1980: tab. 2 (not seen); Sharabati, 1981: 67; Sharabati, 1984: 16, pl. 1, fig. 4; Hulings, 1986: 319.*? Acanthochitona* sp.; Hughes, 1977: 80 & 91.*Acanthopleura raddoni*; (sic) De Brauwert *et al.*, 1981: 165.*Acanthopleura gemmata*; Ferreira, 1983: 278-282, fig. 30 (non *Chiton gemmata* De Blainville, 1825); Ferreira, 1986: 225-233 (pars); Hulings, 1991: 16-25, figs. 1-2; Hulings, 1992: 21-28.*Acanthopleura vaillantii*; Van Belle & Wranik, 1991: 374-375; Kaas & Knudsen, 1992: 62-63, fig. 9.**Type:** MNHN (lectotype, designated by Ferreira, 1986: 231).**Type locality:** Suez Channel, Red Sea.**Material examined:** EGYPT: Na'ama (HLS 1282/40); Sharm el Sheik (HLS 1280/23, HUI 30869/1); Merlin Point (HLS 1279/8); south side Giftun Kebir Island (HLS 1281/17); Giftun Kebir Island (HLS 1649/4, AS 657/2); east side Abu Mingar Island (RMNH/5, AS 660/2); 16 km south of Hurghada (AS 654/1); Sharm el Naga (RMNH/3, AS 656/2); Marsa Abu, Makhadig (HLS 1622/4, AS 574/4); Ras Gamsa, (HLS 1664/1); Quseir (AS 664/1); Dhow Anchorage, 18 km south of Safaga (AS 585/1); El Qalawa (AS 587/2); El Qalawa (RMNH/1); Sherateb, (MNHN/1); Senafir (MNHN/9); Port Ibrahim (Suez) (MNHN/8); Perri (NW of Ibrahim, Suez) (MNHN/7, HLS 1969/3); Port Bhewfik (MNHN/5); 20 km south of Ain Sukhna (RMNH/8); El Barabit, southern point of Gebel Ataka (RMNH/3); Ras Anaka (HLS 1957/2); ISRAEL: Elat (HUI 20676/1, HUI 30875/1, HUI 20679/4, HUI 20680/3, HUI 30870/1, AS 224/1); JORDAN: Al Aqabah (HUI 20679/1, HUI 30873/3,

HUJ 30872/5); **ETHIOPIA:**, Mits'iwa (= Massawa) (HUJ 20677/2); Assab, (RMNH/7, HLS 664/3); **SAUDI ARABIA:**, Jiddah (= Djeddah) (RMNH/1); **YEMEN:**, Kamaran Island (RMNH/3); **RED SEA:** (Zoological Museum, University of Copenhagen/3 = lectotype and paralectotypes *Chiton testudo*).

Description: Largest specimen examined 100 mm in length (AS 664), oval, back rounded. Tegmentum greyish, cream, reddish brown or very dark brown (almost black), sometimes with white longitudinal bands, very often strongly eroded but normally sculptured with round to oval tubercles, but in specimens from southern part of Red Sea arranged in irregular concentric rows on end valves and lateral areas of intermediate valves. Central areas of intermediate valves finely granulated and with growth lines. Insertion plate of posterior valve short, deeply grooved and pectinate. Insertion plate of anterior valve somewhat longer. Girdle wide, with large blackish, brown or white, calcareous spines.

For a more detailed description see Kaas & Van Belle (1988: 123-124).

Habitat: Intertidal on solid rock.

Distribution: Red Sea and Western Indian Ocean.

Remarks: According to Ferreira (1983, 1986) all Red Sea specimens belong to *Acanthopleura gemmata* (Blainville, 1825). I disagree as there is a large (ca. 3300 km wide) distribution gap between populations from the Western Indian Ocean (including the Red Sea) and the Indo-Pacific region, which according to Ferreira (1986: 230) is no collecting artifact. Geographic isolation is the main reason Ferreira (1986: 263) separates the equally similar Caribbean species *Acanthopleura granulata* (Gmelin, 1791) from *A. gemmata*, but he does not use this argument to separate West Indian and Red Sea populations from Indo-Pacific populations of *A. gemmata*. Although Ferreira might be right in concluding that there is only one very variable species occurring in both areas, his argumentation is poor and it is therefore difficult to see how he reached his conclusions.

Kaas & Van Belle (1988: 124) regard the Red Sea, Yemen, Oman and Arabian Gulf populations as distinct from *A. gemmata*, based mainly on arguments by Winckworth (1927) and Leloup (1937). Some of these arguments were tested and proved to be quite debatable. For instance Winckworth states that the shell valves are broader in western Indian Ocean specimens. Comparing 24 specimens from Egypt with 24 specimens from Indonesia (= *A. gemmata* s.s.) of equal length classes, about 30% of the specimens from Indonesia had broader shells. Therefore width of valves can hardly be regarded a reliable discriminating character. The same can be said about other differences recorded by Winckworth like the tail valve being more rounded and the finer sculpture of western Indian Ocean specimens. Although apparently not all the species specific characters described by both Winckworth and Leloup are of diagnostic value, I prefer to follow the view of Kaas & Van Belle and to consider the western Indian Ocean specimens different from *A. gemmata*, and to use the oldest available name for specimens from the Red Sea.

A possible second species of *Acanthopleura* occurs in the southern Red Sea, it is characterized by its darker colour (dark brown, sometimes almost black), by a tegmental sculpture of granules more or less coalesced into fine concentric ridges on head valve, lateral areas of intermediate valves and postmucronal area of tail valve (Pl. 4, Fig. 4), and relative short insertion plates. Most of the specimens from the southern Red Sea have these characteristics, also observed in specimens from adjacent areas such as Yemen and Djibouti. This form resembles *Acanthopleura brevispinosa* (Sowerby, 1840), but all *A. brevispinosa* I could study (16 specimens from 8 localities) had a fine radial sculpture on head valve, lateral areas and postmucronal areas of tail valve and the two forms are apparently not conspecific. The lectotype (designated and figured by Kaas & Knudsen, 1992: fig 9) and paralectotypes of *Chiton testudo* Spengler, 1797 undoubtedly belong to

this form of *Acanthopleura*. They are very dark brown, almost black in colour and have the fine concentric ridges observed in *Acanthopleura* populations from the southern Red Sea. If the above form of *Acanthopleura* proves to be a valid species it should be named *Acanthopleura testudo* (Spengler, 1797) as this is the oldest available name. For the moment the status of *Acanthopleura* forms (except *A. brevispinosa*) in the western Indian Ocean and Red Sea remains unclear and confusing, and, due to variability between and within populations and the lack of sufficient non eroded material from the southern Red Sea, final species allocation in this stage is impossible. It is highly questionable if the problem can be solved by using traditional systematic research methods alone.

Subfamily TONICINAE
Genus *Tonicia* Gray, 1847
Subgenus *Lucilina* Dall, 1882

***Tonicia (Lucilina) sueziensis* (Reeve, 1847)**
 (Pl. 5, Fig. 1, Pl. 6, Figs. 1-2)

Chiton sueziensis Reeve, 1847: pl. 20, spec. & figs. 134; Tillier & Bavay, 1905: 176.

Chiton (Tonicia) sueziensis; Issel, 1869: 235.

Tonicia suezensis; (sic) M'Andrew, 1870: 444; Sykes, 1907: 34; Franc, 1956: 21; Fishelson, 1971: 122; Mergner, 1979: 480 & 498; Mastaller, 1979: 26, 247, 254 & 259.

Tonicia ptygmata De Rochebrune, 1884: 33.

Tonicia (Lucilina) suezensis; (sic) Pallary, 1926: 29-30, pl. 4, fig. 7;

Chiton (Tonicia) suezensis; (sic) Moazzo, 1939: 220.

Tonicia costata; Mergner, 1979: 480 & 498 (nomen nudum); Mastaller, 1979: 26, 247, 254 & 259.

? *Tonicia scabiosus*: Mastaller, 1975: 26 (nomen nudum).

Tonicia dilecta; Mastaller, 1979: 26 (non *Lucilina dilecta* Thiele, 1911).

Tonicia perligera; Mastaller, 1979: 26, 254 & 259 (non *Lucilina perligera* Thiele, 1910); Ferreira, 1983: 274.

Tonica suezensis; (sic) De Brauwert *et al.*, 1981: 165.

Tonicia sueziensis; Ferreira, 1983: 271-274, figs. 25-28; Kaas, 1986: 18.

Non *Lucilina sueziensis*; Lamy, 1938: 88 [= *Callochiton vanninii* Ferreira, 1983 & *Chiton (Tegulaplex) hululensis* (E.A. Smith, 1903)].

Type: BMNH, 1951.2.7.7 (lectotype designated by Ferreira, 1983: 271-272).

Type locality: Gulf of Suez.

Material examined: EGYPT: Suez Canal, near Little Bitter Lake (HLS 1250/7); Na'ama (HLS 1249/76); 5 km south of Na'ama (CAS 077082/1); Sharm el Sheik (HLS 1252/72); Merlin Point (HLS 1251/1, AS 572/1); 6 km north of Hurghada (HLS 1253/1); Hurghada (HLS 1615/36v, ER/34v); between Giftun el Kebir and Giftun el Saghir (BDA 3040/9v); Abu Mingar Island (AS 577/1); Marsa Abu, Makhadiq (AS 575/1, AS 619/1); Sharm el Naga (RMNH/1, AS 655/1); 5 km south of Ras Adabiya (HLS 1398/7v); Dahab (HUJ 20689/5); Wadi Tal (TAUNS 9979/2); Quseir (AS 662/1); 20 km south of Hurghada (RMNH/6); Abulat Island (MNHN/2); Port Bhewfik (MNHN/3); Gulf of Suez (CAS 025183/1); Wadi el Dom, (CAS 076871/3); Gimsah Bay (ZMHU/16); El Tor = El Tur? (ZMHU/12); ISRAEL: Elat (HUJ 20685/1, HUJ 20686/7v, HUJ 20688/4, TAUNS 3225/

1, JPB/2, BDA 3233/1); Elat, Coral Beach, (HLS 254/1); Elat, North Beach (JPB/1); **JORDAN:**, Al Aqabah, (HLS 814/15 & 72v, ER/13 & 64v); 11-12 km south of Al Aqabah, (KBIN IG 26.374/6, 3 as *T. costata* & 1 as *T. perligera*); **SUDAN:**, Sanganeb Reef (BDA/11v); Pt. Sudan, Arons (BDA/4v, HLS 1964/3v); Shabruni Reef (BDA/13v, HLS 1965/6v); **ETHIOPIA:**, Assab (RMNH/1); Dahlak Archipelago, Difuein Island (BDA/5v).

Description: Normally *T. (L.) sueziensis* reaches lengths up to 30 mm. An unusually large specimen 37 x 23.5 mm (HLS 1250) was collected in the Suez Canal. Tegmentum cream to pale yellow mottled with brown, orange and/or black, sometimes partially or completely brown, orange or black specimens do occur. Tegmental sculpture variable. End valves and lateral areas of intermediate valves with many (ca. 30-40 on valve I) irregular granular ribs and conspicuous shiny ocelli (shell eyes). Granules on head valve sometimes dispersed, not forming ribs. Initial part of head valve also with V-shaped rugosities. Central areas of intermediate valves and antemucronal area of tail valve with narrow longitudinal granular ribs (Pl. 6, Fig. 2), generally initial ribs (ribs nearest to the apex) do not reach anterior margin of valve, therefore a relative large jugal area is left smooth, but a few somewhat stronger sculptured specimens have ribs covering almost the entire central area, leaving only a very narrow, ribbon-like, smooth jugal area. Other specimens have broad, flat ribs with narrow interspaces (Pl. 6, Fig. 1). Girdle leathery, smooth, under magnification dorsally covered with very small round-topped, distally grooved spicules.

T. (L.) sueziensis was well described by Leloup (1960: 40-42) (general description, girdle, aesthetes), Ferreira (1983: 270-274) (general description, girdle and radula) and Kaas & Van Belle (1988: 124-125) (girdle and radula).

Habitat: Under dead coral or stones between low water mark and 13 m depth.

Distribution: Entire Red Sea, Somalia, the Seychelles, Coetivy Island, Yemen, Oman and Arabian Gulf.

Remarks: *T. (L.) sueziensis* is a very variable species, a characteristic which can be best observed in the tegmental sculpture (compare Pl. 6, Figs. 1 and 2). The variability of this species was not acknowledged or understood by previous authors. Leloup in particular failed to see this when he recorded five species of *Tonicia* from the Red Sea, of which two were described as new, in an unpublished manuscript on the chitons collected by Mastaller in Jordan. Although this MS was never published the newly proposed names (*T. costata* and *T. scabiosus*) were used in fauna lists by Mastaller (1979: 26) and by Vine (1986: 172). The names remain nomina nuda as no descriptions were given.

Tonicia (Lucilina) perligera (Thiele, 1910)

(Pl. 4, Figs. 5-9)

Lucilina perligera Thiele, 1910: 97, pl. 10, figs. 51-52.

?*Tonicia perligera*; Leloup, 1960: 39-40, fig. 4; Mastaller, 1979: 26, 254 & 259; Leloup, 1980a: 12.

?*Tonicia scabiosus*; Mastaller, 1979: 26 (nomen nudum).

Non *Tonicia perligera*; Ferreira, 1983: 274 [= *Tonicia (Lucilina) sueziensis* (Reeve, 1847)].

Type: ZMHU, holotype.

Type locality: Red Sea.

Material examined: **EGYPT:**, Hurghada (HLS 1614/4v, ER/2v); Giftun Kebir Island, (BDA/1v, HLS 1963/1v); **JORDAN:**, Al Aqabah (HLS 865/38v, ER/30v); ?11-12 km south of Al Aqabah (KBIN IG 26.374/1 = small specimen of *T. scabiosus*); **SUDAN:**, Shabruni Reef (BDA/1v); **RED SEA:**, exact locality unknown (ZMHU/1 = holotype).

Description: Except for the holotype no complete specimens were available. Holotype

contracted 11.5 x 6.5 mm, measurements according to Thiele (1910: 97) 14 x 8 mm; largest valve examined 9.3 mm wide (HLS 865), total estimated length of that specimen must have been about 25 mm. Colour much like that of *T. (L.) sueziensis*; cream mottled with brown, dark grey or orange. Back rounded to subcarinated, dorsal elevation between 0.27-0.39, tegmentum of all valves covered with large (diameter 130-150 μ m in holotype, to 260 μ m in loose valves studied), well separated and high elevated (up to 150 μ m), round to oval granules (Pl. 4, Fig. 5). Jugal area of intermediate valves granulated all over or with a few flat wrinkles or riblets, jugal sinus pectinated, posterior margins of valves I-VII serrated by large granules (Pl. 4, Fig. 8). Shell eyes present but hardly perceptible due to coarse granulation. Tail valve sculptured like intermediate valves, mucro posterior, postmucronal slope steep, straight or slightly convex (Pl. 4, Fig. 6 & 9). Insertion plates well developed, sulcated on outside, slit formula 8/1/8-13 [N = 6 (valve I), N = 8 (valve VIII)].

Holotype has dorsal surface of girdle densely covered with small 30-50 μ m long, cylindrical, distally grooved, rounded or bluntly pointed spicules. Ventral surface paved with small, 30 x 22-25 μ m, squarish scales.

Radula of holotype 4 mm long, comprising 37 rows of mature teeth. Median teeth narrow, ca. 70 μ m long, pinched just behind 20 μ m wide blade; major lateral teeth have 140 μ m wide cusps with 4 bluntly rounded denticles.

Habitat: Unknown. Shell grit from which majority of valves were taken was found in 2-30 m depth.

Distribution: At present known only from the Red Sea.

Remarks: Although the description by Thiele (1910) was based on a complete specimen, he did not give descriptions of the girdle elements or radula. I was able to study the holotype, preserved in alcohol, valves I, V and VIII disarticulated, of which the latter two valves nicely match the figures given by Thiele (1910: pl. 10, figs. 51-52).

I also studied two specimens which Ferreira (1983: 274) reported as *T. (L.) perligera*, but found that they belonged to the form of *T. (L.) sueziensis* which has the central areas sculptured with rather coarse longitudinal granular riblets.

In many respects this species resembles *Tonicia (Lucilina) sueziensis*, but it can be easily differentiated by the sculpture of the tegmentum which has large, well separated granules.

Genus *Onithochiton* Gray, 1847

Onithochiton erythraeus Thiele, 1910

(Pl. 5, Fig. 2)

Onithochiton erythraeus Thiele, 1910: 98, pl. 10, figs. 53-55.

Onithochiton lyelli; Leloup, 1960: 42-51, figs. 7 & 9-13 (non *Chiton lyellii* Sowerby, 1832); Leloup, 1980a: 12.

Onithochiton lyelli forma *erythraeus* Pearse, 1978: 92-100, fig. 3.

Onithochiton literatus Ferreira, 1983: 274-278, fig. 29 (non *Chiton literatus* Krauss, 1848).

Type: ZMHU (holotype).

Type locality: Egypt, El Tor = El Tur?

Material examined: EGYPT: Abu Rudeis (TAU NS 9978/4); Wadi Tal (HLS 1420/1); Wadi el Dom (CAS 076971/9, HLS 2019/1); El Tor = El Tur? (ZMHU/1 = holotype).

Description: Medium sized chiton, largest specimen examined 32 mm (CAS 076971), largest specimen reported 42 mm (Pearse, 1978: 96), somewhat elongate and round backed. Tegmentum shiny, cream mottled with orange, brown and dark grey. Head valve

with irregular, undulating, concentric sculpture and 9-14 rows of ocelli. Lateral areas of intermediate valves not elevated, with concentric sculpture similar to that of head valve, although somewhat less undulating; anterior end of lateral areas with one row of ocelli. Central areas with longitudinal, irregular, slash-like sulci, jugal area smooth in most specimens. Tail valve flat, triangular, mucro terminal; antemucronal area sculptured like central areas of intermediate valves. Slit formula 8/1/0. Girdle dorsally clothed with cylindrical, pointed and distally grooved spicules, up to 130 μm . Ventrally paved with squarish, striated scales 40 x 30 μm (in 31 mm long specimen). Kaas and Van Belle (1988: 125) give quite different measurements for the girdle elements of a specimen from Oman; dorsal spicules 23 x 10 μm and ventral scales 20 x 15 μm .

An extensive description is given by Ferreira (1983: 274-278).

Habitat: Under coral rocks and probably in crevices of solid rock, lower intertidal to shallow subtidal.

Distribution: *O. erythraeus* as here understood occurs in the Red Sea, and in the Western Indian Ocean from Oman in the north to Mauritius in the south.

Remarks: The holotype of *O. erythraeus* was studied and agrees in all respects with *Onithochiton* material from the Red Sea. It measures 9 x 8.5 mm (in rolled up state), valves I, V and VIII are disarticulated, soft parts missing.

Leloup (1960: 42-53) regarded Red Sea *Onithochiton* species as conspecific with *O. lyelli* (Sowerby, 1832) from Pitcairn Island. I have studied the type specimens of *O. lyelli* (BMNH no. 1985064). The syntype series consists of four, dried, well flattened specimens from which the soft parts were removed. The second largest specimen (28.4 x 15.6 mm) is here designated as lectotype (Pl. 5, Fig. 3). In my opinion *O. lyelli* is certainly not conspecific with specimens occurring in the Red Sea. The Pitcairn Island species has a different colour (blue green and dark brown), a different tegmental sculpture (valve V of lectotype has ca. 34 fine, very short ribs on each side of central areas) and a less flattened tail valve.

Ferreira (1983: 274-278) regards *O. erythraeus* conspecific with *O. literatus* (Krauss, 1848) from South Africa. Red Sea specimens were compared with 5 non eroded specimens (HLS 502, 503 & 574) of *O. literatus* from Natal, South Africa. South African specimens differ from those of the Red Sea in being generally more eroded, darker coloured, more strongly sculptured and the lateral areas of intermediate valves have a more irregular and rugose sculpture than those from the Red Sea. On the other hand the girdle elements and radula are remarkably similar in both taxa, which indicate close relationship. On account of the different tegmental sculpture and as no intergradations were observed, I would like to support the opinion of Kaas & Van Belle (1988: 125-126), who already mentioned the difference in sculpture (although unfortunately without indicating what these differences are), and retain the name *O. erythraeus* for specimens from the Red Sea.

Suborder ACANTHOCHITONINA
Family ACANTHOCHITONIDAE
Subfamily ACANTHOCHITONINAE
Genus *Craspedochiton* Shuttleworth, 1853

***Craspedochiton laqueatus* (Sowerby, 1842)**

Chiton laqueatus Sowerby, 1842: 104.

Craspedochiton tetricus; Thiele, 1909: 33, fig 27-28.

Craspedochiton (*Craspedochiton*) *laqueatus*; Franc, 1956: 20; Mastaller, 1979: 25 (ex Franc, 1956).

Placellozona laqueata; (sic) Leloup, 1960: 29.

Phacellozona laqueata; Fishelson, 1971: 122; Leloup, 1980a: 12.

Type: BMNH, no. 1988071 (lectotype, designated herein).

Type locality: Philippines, Mindoro, Calapan.

Material examined: **EGYPT:**, Sharm el Sheik (HLS 1297/2); Ile Abulat, Accore E. au large Orfèvre Sud (MNHN/1); 17 km south of Hurghada (AS 653/1); between Giftun el Kebir and Giftun el Saghir (BDA 3037/1); **JORDAN:**, Al Aqabah (HLS 864/6, ER/3, SAM/1); Al Aqabah (HUIJ 20684/1); **ISRAEL:**, Elat (JPB/2, RMNH/1, AS/1, BDA 3232/1).

Description: Animal of medium size, largest Red Sea specimen recorded 27 x 19 mm (Leloup, 1980: 12), anterior very wide, gradually narrowing towards posterior. Colour variable, tegmentum with different patterns of green, brown, purple and cream; green generally dominating in Red Sea specimens. Girdle mostly green, but sometimes blue, orange or reddish brown.

Head valve broad and flat with five low ribs (occasionally six) corresponding with slits in insertion plates, coarsely sculptured with irregular shaped granules, ranging from roundish to oval to triangular. Intermediate valves with same sculpture, except that jugum of older specimens are smooth with narrow depressions on both sides. Tail valve flat, mucro somewhat anteriorly. Slit formula 5-6/1/7-11.

Girdle dorsally densely clothed with minute (up to 40 µm long) spicules, with 18-20 tufts of 4-6, long (up to 1 mm), cylindrical, smooth, curved needles. Similar, but solitary needles to 600 µm long dispersed on the dorsal area, especially on outer margins. Marginal fringe consists of ca. 200 µm long, striated spicules. Ventrally the girdle with very remarkable clothing of scales. Scales divided into three different types occupying separate zones. Scales around foot are long and slender (largest 160 x 45 µm), surrounded by conspicuous fringe of very large spoon-like scales (largest in 15 mm long specimen: 380 x 150 µm). Fringe best developed posteriorly, does not continue around anal area. Outer margin of girdle consists of smaller and broader scales (largest 100 x 60 µm). All ventral girdle scales finely ribbed.

Thiele (1909) gave a good description of *C. laqueatus* in which he also described the radula and girdle elements.

Habitat: Under rocks in shallow water (0.5 m) up to depths of about 52 m (Seychelles, MNHN).

Distribution: A widespread Indo-Pacific species, known from the northern Red Sea to the Philippines.

Remarks: The syntype series of *C. laqueatus*, was studied and consists of five dried, well flattened specimens, ranging from 11.3 x 6.7 up to 17.5 x 11.3 mm in length. Soft parts are present in the two smallest specimens, but are absent in the three largest ones. The second largest specimen, 17.4 x 11.2 mm, pale violet with green and cream spots, is probably the one figured by Reeve (1847: pl. 20, fig. 135), and here designated as lectotype.

Genus *Acanthochitona* Gray, 1821

Acanthochitona penicillata (Deshayes, 1863)

Chiton penicillatus Deshayes, 1863: 41, pl. 6, fig. 8-10.

Chiton fascicularis; Audouin, 1826: 147-148 (non Linnaeus, 1767).

Chiton (*Acanthochites*) *spiniger*; Issel, 1869: 235 & 317 (non *Chiton spiniger* Sowerby, 1840).

- ?*Acanthochites coarctatus*; M'Andrew, 1870: 444 (non *Chiton coarctatus* Sowerby, 1841).
- ?*Acanthochites scutiger*; M'Andrew, 1870: 444 (non *Chiton scutiger* Reeve, 1847).
- Chiton garnoti*; Maltzan, 1871: 203 (non *Chiton garnoti* Blainville, 1825).
- Acanthochites fascicularis*; Sturany, 1904: 267 (non *Chiton fascicularis* Linnaeus, 1767).
- Chiton discrepans*; Tillier & Bavay, 1905: 175 (non *Chiton discrepans* Brown, 1827).
- ?*Acanthochites nierstraszi* Sykes, 1907: 32-33.
- Acanthochites penicillatus*; Thiele, 1909: 45, pl. 6, fig 10-12; Lamy, 1938: 88.
- Chiton (Acanthochiton) penicillatus*; Pallary, 1926: 28-29, pl. 4, fig. 5; Moazzo, 1939: 218.
- Acanthochitona discrepans*; Tomlin, 1927: 291 (non *Chiton discrepans* Brown, 1827); Mastaller 1979: 25.
- ?*Chiton (Acanthochiton) discrepans*; Moazzo, 1939: 218-219 (non *Chiton discrepans* Brown, 1827).
- Acanthochiton penicillatus*; Franc, 1956: 20; Leloup, 1952: 9-11, text fig. 4, pl. 1, fig. 3, pl. 2, fig. 5; Leloup, 1960: 32; Barash & Danin, 1973: 352; Mastaller, 1979: 25, 238, 242 & 259; Leloup, 1980a: 6.
- Acanthochitona communis*; Barash & Danin, 1977: 14 (non *Acanthochites communis* Risso, 1826); Leloup, 1980a: 1 & 6; Barash & Danin, 1987: 84.
- Chiton fascicularis* var. *gracilis*; Barash & Danin, 1977: 14.
- Acanthochiton fascicularis*; Mastaller, 1979: 25 (non *Chiton fascicularis* Linnaeus, 1767).
- ?*Acanthochiton gracilis*; Leloup, 1980a: 6 (non *Chiton gracilis* Jeffreys, 1859); Barash & Danin, 1987: 84.
- Acanthochitona penicillata*; De Brauwert *et al.*, 1981: 165.
- Acanthochitona* cf. *A. penicillata*; Ferreira, 1983: 284-287, fig. 32.
- Chiton* sp.; Sharabati, 1984: 16, pl. 1, fig. 3b.
- ?*Acanthochitona* sp.; Sharabati, 1981: 73.

Type: ?, probably lost.

Type locality: Réunion.

Material examined: EGYPT: 5 km south of Ras Adabiya (HLS 1395/6); Suez Canal, near Little Bitter Lake (HLS 1284/13); Uyun Musa (HLS 1288/11); Na'ama (HLS 1283/17); Sharm el Sheik (HLS 1285/19); Merlin Point (HLS 1287/48); Giftun Kebir Island (HLS 1289/1); between Giftun el Kebir and Giftun el Saghir (BDA 3036/1 & 6v); Hurghada (HLS 1616/14v, ER/12v); 6 km north of Hurghada (HLS 1286/30); 7 km south of Hurghada (HLS 2023/1, AS 650/1); 16 km south of Hurghada (HLS 1849/1, AS 652/2); Ras Gamsa (HLS 1623/2); Marsa Abu, Makhadig (HLS 1650/3, AS 573/2); Abu Mingar Island (AS 578/4); east side Abu Mingar Island (near Hurghada) (RMNH/1); Dhow Anchorage, 18 km south of Safaga (AS 584/1); Marsa Murach (TAU NS 3078/1); Abulat Island (MNHN/2); Port Bhewfik (MNHN/2, HLS 1993/1); ISRAEL: Elat (HUJ 20681/1); JORDAN: Al Aqabah (HLS 1298/38v); 11-12 km south of Al Aqabah, (KBIN IG 26.374/1); SUDAN: Sanganeb Reef (BDA/1v); Pt. Sudan, Arons (BDA/3v); Shabruni Reef (BDA/2v).

Description: Medium sized chiton, largest Red Sea specimen examined 27 mm long (Suez Canal, HLS 1284). Colour variable, mostly cream variegated with black, brown, green or yellow, a few specimens uniform white, cream, orange, red or black. Animal moderately raised, subcarinated. Tegmentum densely covered with pyriform or drop-shaped granules, variable in form, from almost round (seldom) to elongate pyriform, and

in size. Jugal areas well defined, little raised, smooth except for growth lines, with about 10-12 striae on average (ca. 20 mm long) sized specimens. Slit formula 5/1/2.

Girdle dorsal surface densely covered with small, thin, glassy spicules up to 90 µm long, and interspersed with large, curved spicules up to 800 x 50 µm. Ventral girdle scales long, narrow, and sharply pointed [not rectangular as stated by Ferreira (1983: 286)], up to 140 x 20 µm.

See for an extensive description of *A. penicillata* Ferreira (1983: 285-286). Leloup (1952: 10) depicted the girdle elements.

Habitat: Under stones and dead coral from mean low water to at least 4 meters.

A. penicillata can crawl on sand. I saw several specimens creeping on sand in Uyun Musa, Egypt. Furthermore R. Viader (in Leloup, 1941: 2) makes the following remark about this species "il s'aventure souvent sur le sable environnant ou il s'enfouit lorsqu'il est surpris par la maree basse". The same behaviour has also been observed in the east American species *Acanthochitonapygmaeus* (Pilsbry, 1893). Ms. R. Melvin saw specimens burrowing in sand and collected them by following the trails they left in the sand (in litt, 1985). Similar behaviour has also been observed in other species from different genera such as *Pseudotonicia cuneata* (Suter, 1908) (Gowlett-Holmes, 1991: 87, fig. 3) and *Chaetopleura angulata* (Spengler, 1797) (Mr. G. van den Ende, pers. comm.).

Distribution: Red Sea, Suez Canal and Western Indian Ocean, from Arabian Gulf to Madagascar.

Remarks: *Acanthochiton nierstraszi* was described by Sykes (1907) from material collected from a dock wall and from mud-flats at Suez, Egypt. Although Sykes states that a good series was collected, no material could be found in the BMNH (Mrs. S. Morris pers. comm. 9.III.1988, and Mrs. K. Way in litt. 28.V.1991). Furthermore K. Way informed me that the material collected by Crossland in the Red Sea was deposited in Liverpool University, but Dr. I. Wallace of the Liverpool Museum (in litt., 13.I.1992) informed me that the material has probably been lost.

As Sykes provided no illustrations, we can only rely on his description. Based on that description I regard *A. nierstraszi* a junior synonym of *A. penicillata*.

Acanthochiton mastalleri Strack, 1989

Acanthochiton mastalleri; Mastaller, 1979: 25 & 254; Vine, 1986: 172 (nomen nudum).

Acanthochiton mastalleri Strack, 1989: 169-172, pls 19-20.

Type: ZMA, no. 388029/1 (holotype).

Type locality: Egypt, 6 km north of Hurghada.

Material examined: EGYPT:, Merlin Point (ZMA 388029/1 = holotype, HLS 1276/1 = paratype); 6 km north of Hurghada (HLS 1277/9 = paratypes); Hurghada (HLS 1617/1v, ER/1v); Marsa Abu, Makhadig (AS 668/1); JORDAN:, Al Aqabah (ER/1 & 2v, HLS 1278/5v = paratypes); 11-12 km south of Al Aqabah (KBIN no. IG 26.374/1, Bochum Universität/1 = paratypes); SUDAN:, Pt. Sudan, Arons (BDA/1v).

Description: Animal of moderate size, to 16 x 9.5 mm, little elevated, colour whitish maculated with brown or grey, granules white. Tegmentum sculptured with irregular, more or less oval, flat-topped to slightly concave granules. Jugal area raised, narrow, sharply separated from latero-pleural areas and with 4-7 striae. Latero-pleural areas much reduced, with deeply concave anterior margins. Tail valve with prominent mucro, just behind center. Slit formula 5/1/2. Girdle very wide, strongly encroaching at sutures, dorsally densely covered with minute (20-40 µm long) cylindrical, smooth spicules, interspersed with smooth, straight or slightly curved, longer (70-100 µm) spicules; with 18 very poorly developed and inconspicuous tufts. Ventral girdle scales flattened, straight, smooth and

sharply pointed, mostly 40-70 µm in length.

See for a more detailed description Strack (1989).

Habitat: Under stones, dead coral and shells, from low tide mark to 0.5 m depth.

Distribution: Red Sea and Oman (Strack, Moolenbeek & Dekker, in preparation). Specimens recorded as *Cryptoconchus porosus* Burrow, 1815 by Leloup (1981a: 21 and 1981b: 1) from Tuléar and Mayotte, and a specimen recorded as *Cryptoconchus burrowi* (Nierstrasz, 1905) by Van Belle & Wranik (1992: 378, fig. 24) from Socotra Island, Yemen (Gulf of Aden) are probably misidentified specimens of *A. mastalleri*.

Genus *Notoplax* H. Adams, 1861

Subgenus *Leptoplax* (Carpenter MS) Dall, 1882

Notoplax (Leptoplax) curvisetososa (Leloup, 1960)

?*Acanthochites coarctatus*; M'Andrew, 1870: 444 (non *Chiton coarctatus* Sowerby, 1841).

Acanthochiton curvisetosus Leloup, 1960: 29-31, fig. 1, pl. 1, fig. 2; ?Fishelson, 1971: 122; Mastaller, 1979: 25.

Notoplax elegans; Mastaller, 1979: 25, 238, 242 & 254 (nomen nudum); Leloup, 1981a: 33-35, text fig. 17, pl. 3, fig. 3 (description).

Notoplax aqabaensis; Mastaller, 1979: 25, 238 & 254; Vine, 1986: 172 (nomen nudum).

Type: IRSN no. I.G. 22.375 (lectotype, designated herein).

Type locality: Israel, Elat.

Material examined: EGYPT: Na'ama (HLS 1295/1); JORDAN: Al Aqabah (HLS 1296/3v, ER/1v); 11-12 km south of Al Aqabah (IRSN IG 24.835/2); ISRAEL: Elat (IRSN I.G. 22.375/1 = lectotype & girdle and radula = paralectotype).

Description: Animal small, maximal length 11 x 5.5 mm (Leloup, 1960: 29), moderately elevated, colour whitish with small brown and pink spots or completely pink. Tegmentum sculptured with rather large, wide, triangular granules. Jugum wide, with 12-15 striae. Tail valve larger than head valve, mucro prominent and somewhat posterior, postmucronal slope straight and rather steep. Slit formula 5/1/6-8.

Girdle narrow, with 18 inconspicuous tufts of spicules. Dorsal surface densely covered with small (60-90 µm long), transparent, angularly curved, distally striated and pointed spicules, interspersed with larger (up to 230 µm), brownish or colourless, transparent, straight or slightly curved and bluntly pointed spicules. Ventral girdle elements similar to the small dorsal spicules, but not curved and slightly smaller.

Radula with 30-41 rows of mature teeth. Major lateral teeth with tricuspid head, denticles sharp, median one longest.

Gills abanal and merobranchial, 10-13 gills per side, anteriormost gill situated halfway valve V.

Habitat: Under stones and dead coral, from 0.5 m to 36 m depth.

Distribution: Red Sea and Madagascar; also recorded by Leloup (1981b) as *Acanthochiton curvisetosus* from Iles Glorieuses.

Remarks: This species is easily recognised by the rather large triangular granules on the lateropleural areas and by its peculiar angularly curved dorsal girdle spicules.

It was first described by Leloup (1960), but was mistaken for an *Acanthochitona* because he studied only the tail valve of a malformed seven-valved specimen, with a large fissure at the posterior edge of the tail valve. Because of this fissure only two slits were counted.

Study of the second syntype revealed that between the two outer slits there are six additional slits, and therefore the species belongs to the genus *Notoplax*.

The slightly damaged (valves I-III and V-VII broken), rolled up and alcohol preserved syntype (E 49/52) is here designated the lectotype. Although it is not the figured specimen (except for a few girdle elements) it is preferable not to designate a malformed specimen as the lectotype.

Leloup (1981a) described the same species again as *Notoplax elegans*. I studied paratype material of this species from Tuléar, and it proved to be conspecific with *N. (L.) curvisetosa*.

Notoplax s.s. is apparently restricted to a few rather large, very spiculate, sponge dwelling species (Gowlett-Holmes, 1991), therefore I have placed *N. curvisetosa* in the subgenus *Leptoplax* Dall, 1882, the type species of which, *Chiton coarctatus* Sowerby, 1841, has many affinities (e.g. similar tegmental sculpture, girdle elements and habitat) with *N. curvisetosa*.

Family CRYPTOPLACIDAE
Subfamily CRYPTOPLACINAE
Genus *Cryptoplax* Blainville, 1818

***Cryptoplax sykesi* Thiele, 1909**

Cryptoplax sykesi Thiele, 1909: 53-54, pl. 6, figs. 83-86; Leloup, 1960: 32-35, fig. 2; Mastaller, 1979: 25.

Cryptoplax striatus; Sturany, 1904: 267 (non *Chitonellus striatus* Lamarck, 1819); Sykes, 1907: 33 (Red Sea record?).

Choneplax parvus; Mastaller, 1979: 26, 238, 254 & 259.

Cryptoplax enigmaticus Leloup, 1980a: 7-10, pl. 1, fig. 1-2, pl. 2, fig. 1.

Type: ZMHU (syntypes).

Type locality: Egypt?, Gimsah Bay (Red Sea).

Material examined: EGYPT:, 6 km North of Hurghada (HLS 1293/1); Sharm el Sheik (HLS 1294/1); Hurghada (HLS 1618/14v, ER/6v); 7 km south of Hurghada (AS 615/2); Ras Kamisa (BDA 3642/2 = syntypes of *Cryptoplax enigmaticus*); EGYPT?:, Gimsah Bay (ZMHU/1 = syntype); JORDAN:, Al Aqabah (HLS 1050/46v, ER/20v); 11-12 km south of Al Aqabah (KBIN IG 24.835/1); ISRAEL:, Elat (KBIN IG 24.835/1 = syntype of *C. enigmaticus*).

Description: Medium sized chiton, largest Red Sea specimen examined 22 mm long (AS 615), largest specimen recorded 31 mm (Ferreira, 1983: 287; from Zanzibar). Animal vermiform elongated, but relatively wide for genus, valves small, not separated from each other, colour white or light brown mottled with reddish brown or dark brown. Valves elongate and convex, with raised, smooth jugum and 4-7 rows of granules, often coalescing into longitudinal riblets, on each side of jugum. Mucro of tail valve posterior, postmucronal slope mostly convex. Slit formula 3/0/0. Girdle dorsally densely clothed with straight round topped spicules up to 150 x 40 µm, interspersed (sometimes densely) with larger (up to 370 x 60 µm), curved spicules. Ventrally covered with slender, sharply pointed spicules up to 100 x 12 µm.

A more detailed description of *C. sykesi* can be found in Leloup (1980a: 8-10, as *C. enigmaticus*), Ferreira (1983: 287-289) and Kaas (1986: figs. 73-81).

Habitat: In dead coral and under stones from low water mark to 25 m.

Distribution: Western Indian Ocean from the northern Red Sea to Durban, South Africa; easternmost records Madagascar, Réunion and Mauritius. Leloup (1937: 2, as *C. dawydoffi* and 1940: 9-13) recorded *C. sykesi* from Vietnam, a record that needs verification.

Remarks: Although Leloup at first recognized *C. sykesi* as a western Indian Ocean species, occurring in the Red Sea (1960: 32-35), he later described the same species twice; first as *Cryptoplax enigmaticus* Leloup, 1980, later as *Choneplax parvus* Leloup, 1981. The synonymy of the former was suggested by Ferreira (1983: 289). Description and illustrations of the latter totally agree with the description and specimens of *C. sykesi*, therefore it is here regarded as a junior synonym of *C. sykesi*.

DISCUSSION

Knowledge of the distribution of chitons in the Red Sea remains largely insufficient. The data available reflect the uneven distribution of collecting sites rather than reliable zoogeographical distribution patterns. From localities in the North (Gulf of Suez and Gulf of Aqaba) relatively large collections are available for study, but there is little material from areas south of the two gulfs. From Saudi Arabia (which constitutes almost the entire east coast of the Red Sea) for instance there are only very few records and specimens from around Jiddah (= Djeddah). The situation in Sudan, Ethiopia and Yemen is not much better. Only about 8 % of all records and 2 % of all studied specimens originate from the central and southern Red Sea which constitutes 75 % of the studied area. These records are mainly based on a few, old museum specimens and have not been reconfirmed recently. Therefore it is impossible to indicate how many western Indian Ocean species penetrate into the Red Sea and to what extent.

At the species level the situation is similar. Of the 23 species reported in this paper, six [*Lepidochitona monterosatoi* Kaas & Van Belle, 1981, *Lepidozona luzonica*, *Callistochiton adenensis*, *Schizochiton jousseaumei*, *Chiton (Rhyssoplax) heterodon* and *Chiton peregrinus*] are only known from one or two, in most cases very old, records. Except for *L. monterosatoi* these species probably only occur in the southern Red Sea. The occurrence in the Red Sea of three further species [*Leptochiton nierstraszi*, *Leptochiton (Parachiton)* sp. and *Tonicia (Lucilina) perligera*] is only ascertained by one or very few records of loose valves alone.

Hitherto no Red Sea records of species belonging to the large and widespread suborder Lepidopleurina were known. In this paper the occurrence in the Red Sea of three species [*L. nierstraszi* Leloup, 1981, *Leptochiton (Parachiton) hylkiae* n. sp. and *Leptochiton (Parachiton)* sp.] is ascertained.

Antillessepsian migration (from Mediterranean to Red Sea) of chitons has been reported by Leloup (1980a). Barash & Danin (1987), followed Leloup in recording 6 species as antillessepsian migrants. I studied the material reported by Leloup, and found that all former reports of antillessepsian migration of chitons are due to misidentifications. The only possible record of antillessepsian migration is that of two specimens of *L. monterosatoi*. These were misidentified by Leloup (1980a: 11) who recorded them as *Middendorfia caprearum* (Sacchi, 1836) [= *Lepidochitona corrugata* Reeve, 1848], a common Mediterranean species. As *L. monterosatoi* was only recently described from the Mediterranean, there is no proof of its occurrence in the Mediterranean before the opening of the Suez Canal (1869). Its status as probable antillessepsian migrant is at present only based on the fact that this species is far more common in the Mediterranean.

Lessepsian migration in chitons is a rare phenomenon, and the only known record is two specimens of *Chiton (Tegulaplex) hululensis*, recorded by Barash & Danin (1977: 13) from the Mediterranean coast of Israel.

Endemism is believed to be very high in the Red Sea. Percentages of 70% for crinoids, 31% for decapod Macrura, 33% for decapod Brachyura (Ekman, 1953: 28-29) and 36% for opisthobranchs (Heller & Thompson, 1983: 345) are recorded. Such high percentages do not correspond with results presented here in which only 9% (two species, e.g. *L. (P.) hylkiae* and *T. (L.) perliger*) of the chitons are endemic. At present 16 of the 23 species (= ca. 70%) are also known in the western Indian Ocean, and an additional 3 [*L. luzonica*, *C. (T.) hululensis*, and *Craspedochiton laqueatus*] are widespread Indo Pacific or Indo-West Pacific species. The above results demonstrate that the Red Sea chiton fauna has strong affinities with the western Indian Ocean fauna, and does not constitute a separate zoogeographical entity.

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- Plate 1.** 1. *Leptochiton nierstraszi* (Leloup), Hurghada, Egypt (HLS 1611), intermediate valve, 28 x. 2-8. *Leptochiton (Parachiton) hylkiae* n.sp., Sharm el Sheik, Egypt, paratype (HLS 1953): (2) head valve, 13 x; (3) valve IV, 11 x; (4) tail valve, dorsal view, 11 x; (5) tail valve, lateral view, 11 x; (6) valve IV, detail, 16 x; (7) valve IV, sculpture central area, 129 x; (8) marginal spines, 230 x.
- Plate 2.** 1-3. *Leptochiton (Parachiton) hylkiae* n.sp., Sharm el Sheik, Egypt, paratype, (HLS 1953): (1) dorsal girdle scales, 550 x; (2) half row of radular teeth, 133 x; (3) radula, cusps major lateral teeth, 275 x. (4) *Leptochiton (Parachiton) hylkiae* n.sp., south side Giftun Kebir Island, Egypt, holotype (RMNH 9313), 4.8 x. 5-7. *Leptochiton (Parachiton)* sp., Hurghada, Egypt (HLS 2031): (5) tail valve, dorsal view, 22 x; (6) tail valve, lateral view, 28 x; (7) tail valve, sculpture antemucronal area, 130 x. 8. *Callochiton vanninii* Ferreira, Merlin Point, Egypt (HLS 1290), 4 x. 9. *Lepidochitona monterosatoi* Kaas & Van Belle, Manolas, Thirassia, Greece (HLS 1119), 5 x.
- Plate 3.** 1. *Lepidozona luzonica* (Sowerby) [=lectotype *Lepidopleurus concharum* De Rochebrune], Red Sea (MNH), 3.5 x. 2. *Ischnochiton yerburyi* (E.A. Smith), Merlin Point, Egypt (HLS 1246), 2.2 x. 3. *Callistochiton adenensis* (E.A. Smith), Red Sea (HLS 1995), 1.8 x. 4-5. *Schizochiton jousseaumei* Dupuis, Barim Island, Yemen, holotype (MNH): (4) partly disarticulated animal with valves III-VI, 3.9 x; (5) disarticulated valves I, II, VII & VIII, 3.1 x. 6-7. *Schizochiton jousseaumei* Dupuis, Socotra Island, Yemen (R.A. Van Belle): (6) valves I, V, VIII, 1.8 x; (7) valve VIII, ventral view, 3.8 x. 8. *Chiton peregrinus* Thiele, Djibouti (MNH), ca. 1.4 x. 9. *Chiton (Tegulaplex) hululensis* (E.A. Smith), between Giftun Kebir and Giftun Saghir, Egypt (BDA 3042), 1.8 x.
- Plate 4.** 1. *Chiton (Rhyssoplax) affinis* Issel, Sharm el Sheik, Egypt, (HLS 1264), 2.0 x. 2. *Chiton (Rhyssoplax) maldivensis* (E.A. Smith), Na'ama, Egypt, (HLS 1291), 3.2 x. 3. *Acanthopleura vaillantii* de Rochebrune, Sharm el Sheik, Egypt (HLS 1280), 1.1 x. 4. *Acanthopleura* cf. *vaillantii* de Rochebrune [= *Acanthopleura testudo* (Spengler)?], Aden, Yemen (RMNH), 1.4 x. 5-9. *Tonicia (Lucilina) perliger* (Thiele), Al Aqabah, Jordan, (HLS 865): (5) sculpture antemucronal area tail valve, 70 x; (6) tail valve, lateral view, 13.5 x; (7) head valve, 11.3 x; (8) intermediate valve, 11.3 x; (9) tail valve, 11.3 x.
- Plate 5.** 1. *Tonicia (Lucilina) sueziensis* (Reeve), Suez Canal, near Little Bitter Lake, Egypt (HLS 1250), 1.8 x. 2. *Onithochiton erythraeus* Thiele, Wadi el Dom, Egypt (CAS 076971), 1.7 x. 3. *Onithochiton lyelli* (Sowerby), Pitcairn Island, lectotype, (BMNH 1985064), 1.8 x. 4. *Craspedochiton laqueatus* (Sowerby), Calapan, Mindora Island, Philippines, lectotype (BMNH 1988071), 2.3 x. 5. *Craspedochiton laqueatus* (Sowerby), Sharm el Sheik, Egypt, juvenile specimen (HLS 1297), 3.4 x. 6. *Acanthochitona penicillata* (Deshayes), Merlin Point, Egypt (HLS 1287), 2.0 x. 7. *Acanthochitona mastalleri* Strack, Merlin Point, Egypt, paratype (HLS 1276), 3.2 x. 8. *Notoplax (Leptoplax) curvisetosa* (Leloup), Al Aqabah, Jordan (IRS IG 24.835), 5.6 x. 9. *Cryptoplax sykesi* Thiele, 6 km North of Hurghada (HLS 1293), 2.7 x.
- Plate 6.** 1. *Tonicia (Lucilina) sueziensis* (Reeve), near Little Bitter Lake, Suez Canal, Egypt (HLS 1250), valve IV, 6.0 x. 2. *Tonicia (Lucilina) sueziensis* (Reeve), Sharm el Sheik, Egypt (HLS 1252), valve V, 6.9 x. 3-6. *Chiton (Rhyssoplax) heterodon* (Pilsbry), Djibouti (RMNH): (3) dorsal girdle scales, 108 x; (4) head valve, 6.9 x; (5) valve IV, 6.9 x; (6) tail valve, 6.9 x.
- Plate 7.** 1-2. *Leptochiton nierstraszi* (Leloup), Hurghada, Egypt (HLS 1611): (1) granule of intermediate valve, lateral view, 145 x; (2) worn granule on jugal area intermediate valve, dorsal view, 145 x. (3.) *Ischnochiton yerburyi* (E.A. Smith), Sharm el Sheik, Egypt (HLS 1248), girdle, marginal needle, 145 x. 4-7. *Schizochiton jousseaumei* Dupuis, Socotra Island, Yemen [R.A. Van Belle (radula) & HLS 1996 (girdle elements)]: (4) radula, cusp major lateral tooth, 220 x; (5) ventral girdle spicule, 145 x; (6) dorsal girdle spicule, 145 x; (7) dorsal girdle spinelet, 110 x. 8-9. *Chiton (Tegulaplex) hululensis* (E.A. Smith), Giftun el Saghir, Egypt (HLS 1851): (8) radula, central tooth, 145 x; (9) radula, cusp major lateral tooth, 145 x; 10-16. *Chiton (Rhyssoplax) maldivensis* (E.A. Smith), Na'ama, Egypt (HLS 1291): (10) radula, central tooth, 145 x; (11) radula, cusp major lateral tooth, 145 x; (12) girdle, marginal needle, 145 x; (13) girdle, marginal spicule, 145 x; (14) ventral girdle scales, 145 x; (15) isolated dorsal girdle scale, 145 x; (16) dorsal girdle scales in situ, 145 x.

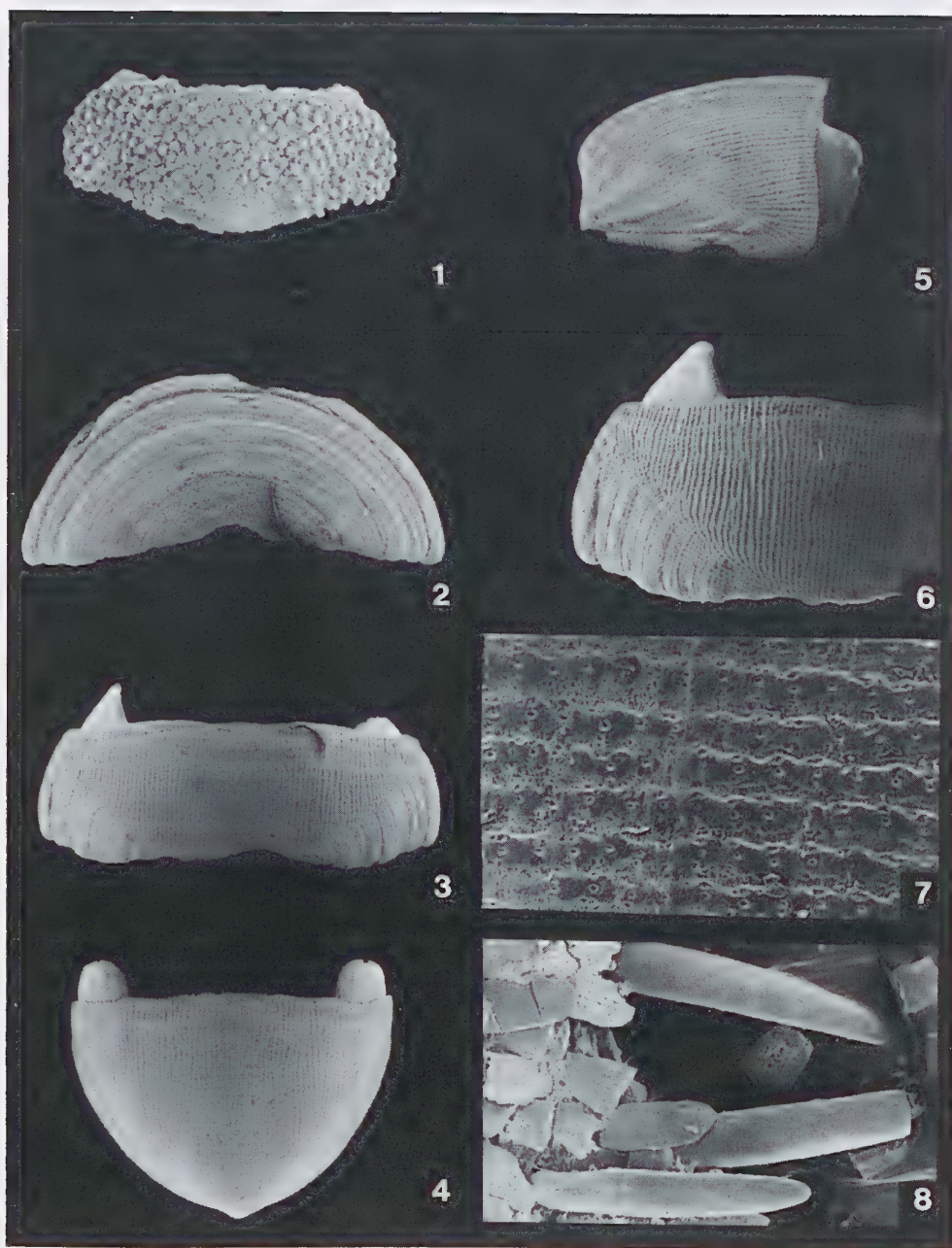


Plate 1.

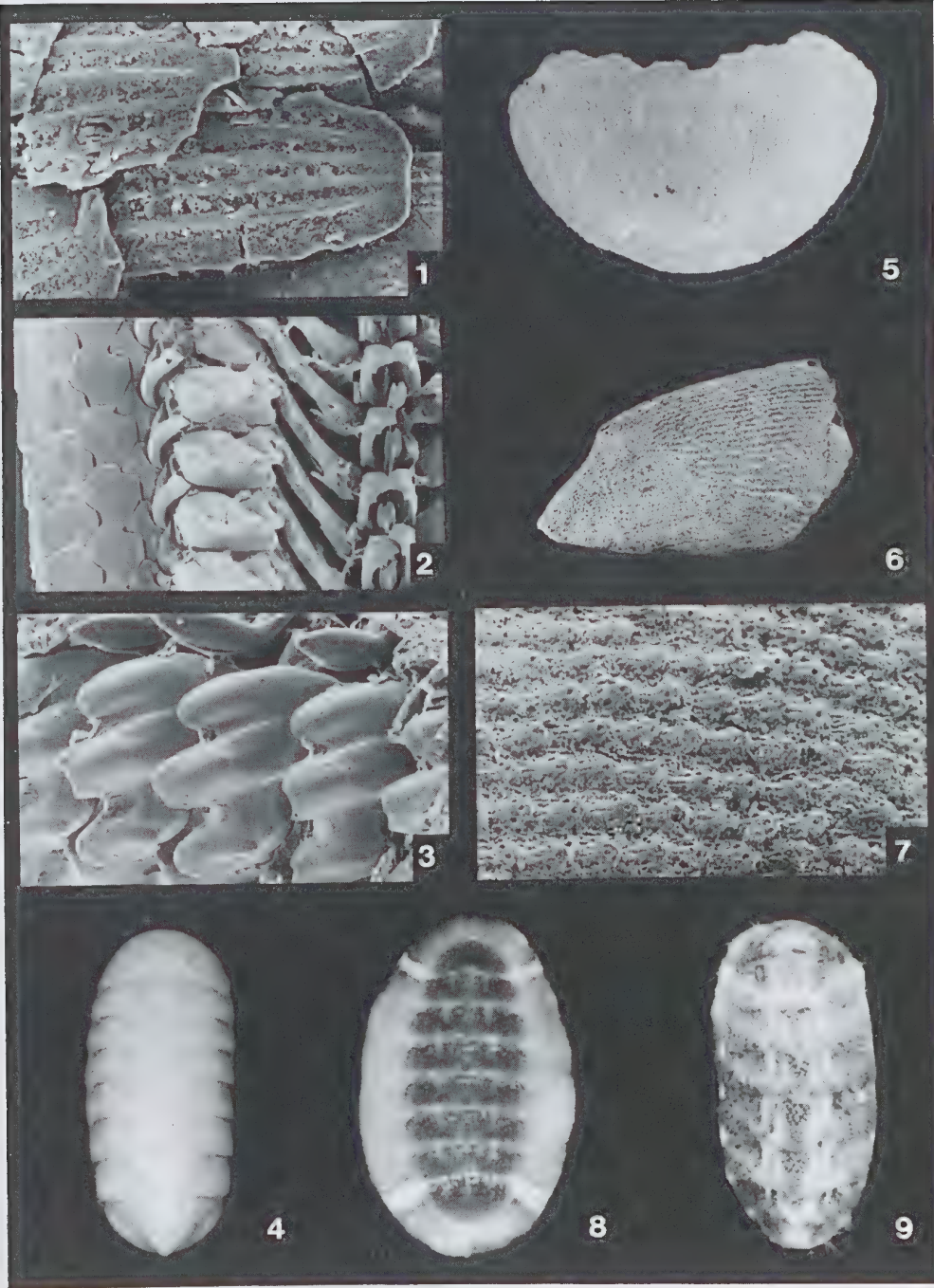


Plate 2.



Plate 3.

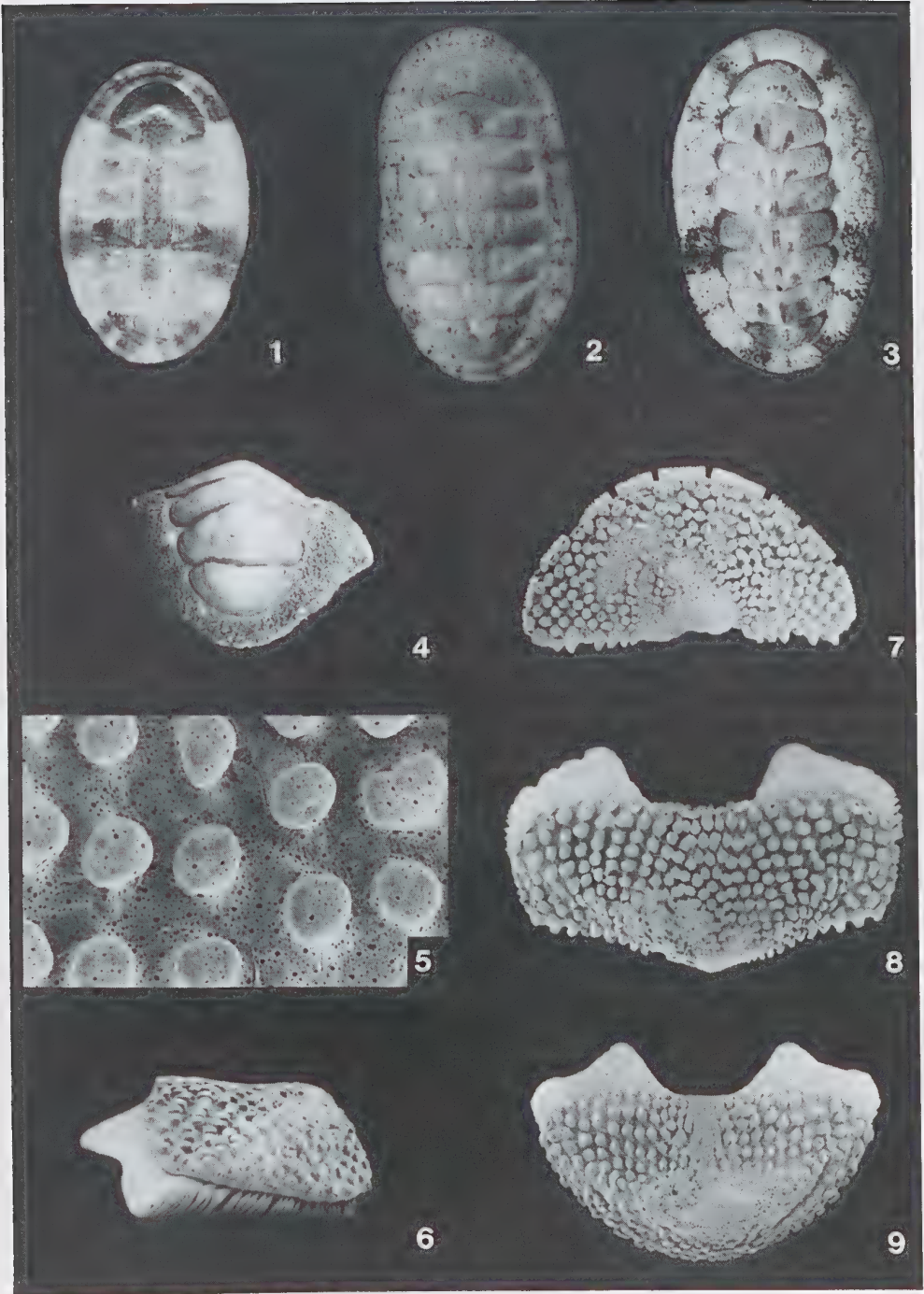


Plate 4.



Plate 5.



Plate 6.

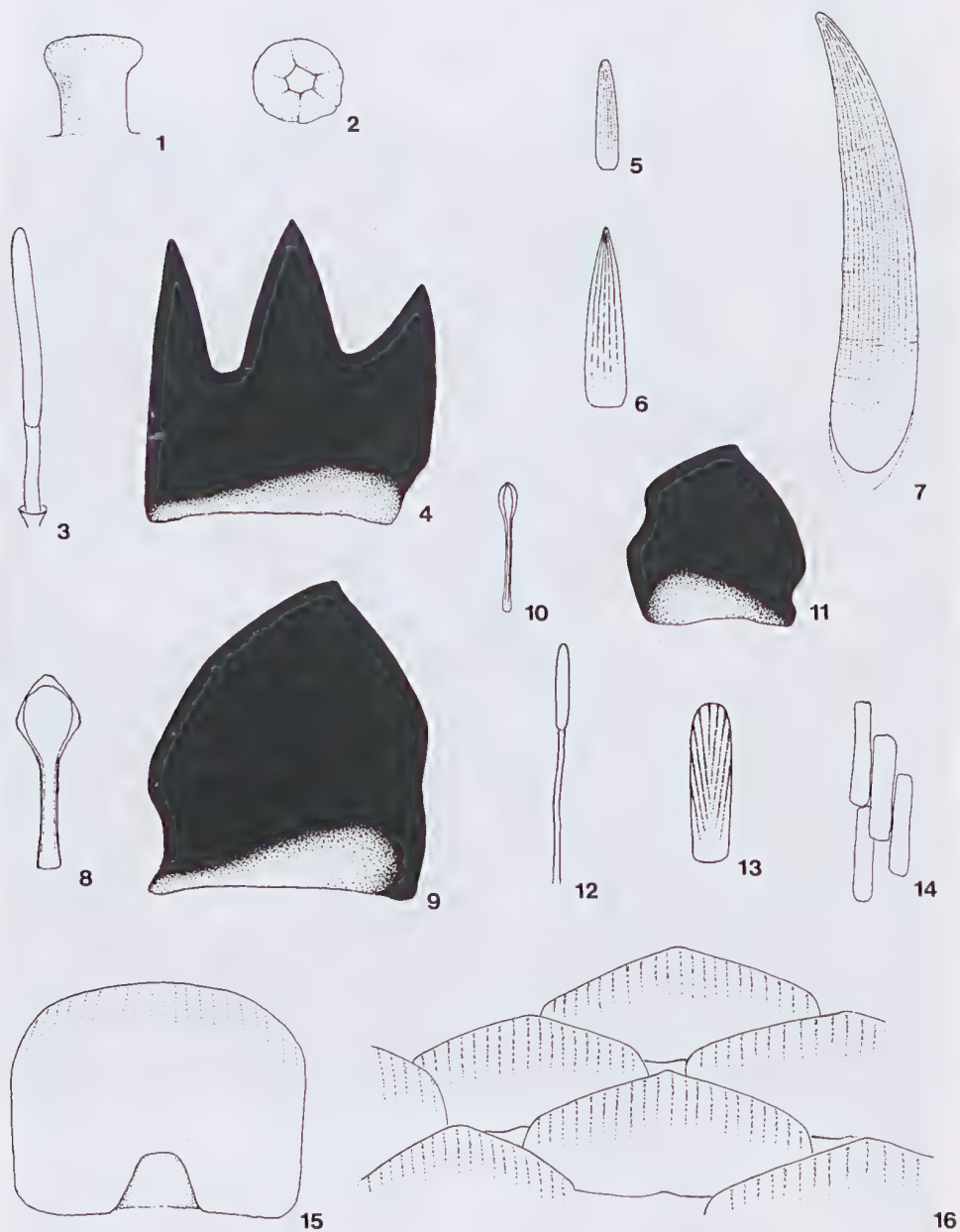


Plate 7.